WOODWORTH AVENUE WORKS
YONKERS, NEW YORK
INTERIM REMEDIAL MEASURE WORK PLAN
FORMER MANUFACTURED GAS PLANT SITE
(NYSDEC SITE NO. 360164)



CONSOLIDATED EDISON CO. OF NEW YORK, INC.
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Professional Engineer Certification

I, Matthew J. O'Neil, certify that I am currently a NYS registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

July 19, 2023
Date

Matthew J. O'Neil
GEI Consultants, Inc., P.C.
New York State Professional Engineer
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It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

Abbreviations and Acronyms

AOC	Administrative Order on Consent
BTEX	Benzene, Toluene, Ethyl benzene, and Xylene
CAMP	Community Air-Monitoring Plan
CCR	Construction Completion Report
COC	Constituent of Concern
Con Edison	Consolidated Edison Company of New York, Inc.
DER-10	[Division of Environmental Remediation]-10, Technical Guidance for Site Investigation and Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	United States Environmental Protection Agency
ft bgs	Feet below ground surface
GEI	GEI Consultants, Inc., P.C.
HASP	Health and Safety Plan
IRMWP	Interim Remedial Measure Work Plan
ISMP	Interim Site Management Plan
LNAPL	Light Non-Aqueous Phase Liquid
MGP	Manufactured Gas Plant
NYCRR	New York Codes, Rules and Regulations
NYS AWQS	New York State Ambient Water Quality Standards
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAHs	Polycyclic Aromatic Hydrocarbons
PPE	Personal Protective Equipment
RAO	Remedial Action Objectives
RI	Remedial Investigation
SC	Site Charaterization
SCGs	Standards, Criteria and Guidance values
SCOs	Soil Cleanup Objectives
SVOC	Semivolatile Organic Compound
VOCs	Volatile Organic Compounds

1. Introduction

The Consolidated Edison Company of New York, Inc. (Con Edison) has entered into a Consent Agreement with the New York State Department of Environmental Conservation (NYSDEC) to investigate and remediate potential contamination at several former manufactured gas plant (MGP) properties. One of these properties is known as the former Woodworth Avenue Works Manufactured Gas Plant Site (herein referred to as the "Site") (Site ID No. 360164) in Yonkers, Westchester County, New York. At the time of this Work Plan, the Site is comprised of two Operable Units (OU). OU-1 includes the former MGP Site, which is comprised of three blocks and seven lots bounded by Woodworth Avenue to the east, Alexander Street to the west, Ashburton Avenue to the south, and Babcock Place to the north. OU-2 includes the side- and down-gradient impacts associated with the former operations of OU-1. Work at the Site is conducted under Administrative Order on Consent (AOC) Index No. CO0-20180516-519, Site No. 360164, signed July 25, 2018, between Con Edison and the New York State Department of Environmental Conservation (NYSDEC). Work at the Site prior to 2017 was conducted under a Voluntary Cleanup Agreement (Index No. D2-0003-02-08) until the Voluntary Program ended on March 31, 2018.

The owner of three properties on the eastern portion of the OU-1, Block 2100, Lot 10 (95 Woodworth Avenue), Block 2100, Lot 4 (107 Woodworth Avenue) and Block 2100, Lot 1 (119 Woodworth Avenue), is planning to redevelop the properties. In consultation with the NYSDEC, Con Edison has prepared this Interim Remedial Measure Work Plan (IRMWP) presenting the selected IRM for OU-1 to address the documented MGP-related impacts on the eastern portion of the site prior to the redevelopment of the properties.

This IRMWP presents a summary of the remedial investigation and subsequent investigations, the remedial action goals and objectives, and the MGP-impacted material excavation and restoration. The Work Plan focuses only on the parcels on the eastern portion of OU-1 that will be accessed during the IRM, and not the Site in its entirety. It also presents the techniques used for material handling, waste characterization, processing, transportation, and disposal of the MGP-impacted material. This effort will be performed under the approval and oversight of the NYSDEC.

1.1 Site Description and History

The former MGP site occupies 4.3 acres of land bounded by Woodworth Avenue to the east, Alexander Street to the west, Ashburton Avenue to the south, and Babcock Place to the north located in Yonkers, Westchester County, New York. OU-1 is composed of three blocks and seven lots. Metro-North Commuter Railroad runs north-south, bisecting OU-1 into its western and eastern portions. Most of the surface area of OU-1 (approximately 90%) is developed and covered by buildings and asphalt surfaces. The remaining 10% is fill that was

likely imported to the Site after the MGP was decommissioned. The eastern portion of OU-1 is located approximately 25 feet above North American Vertical Datum (NAVD) on a hillside sloping downward toward the Hudson River, to the west. The western portion of OU-1 is approximately 5 feet above NAVD and continues to gradually slope down toward the Hudson River.

The Woodworth Avenue Works was incorporated in 1854 by the Yonkers Gas Light Company on the eastern portion of OU-1. The Yonkers Gas Light Company continued to expand and subsequently purchased the western portion of OU-1 (currently identified as Block 2618, Lots 1, 2, and 200) in 1861. The MGP was dismantled in 1930, with the demolition of remaining structures in 1931. The 1940 aerial photographs and 1942 Sanborn Maps confirm that most of the above ground portions of the plant were removed by that time. However, the two buildings on the northeast corner of OU-1 along Woodworth Avenue remained.

The Woodworth Avenue Works former MGP Site is zoned Industrial. Five buildings were located on the eastern properties of OU-1 at the time of the Remedial Investigation and were utilized as follows:

- Block 2100, Lot 1 was occupied by tenants and the use is unknown.
- Block 2100, Lot 4 was occupied by tenants and the use is unknown.
- Block 2100, Lot 10 was used for auto repair. Upon the RI fieldwork, this property was observed as an active vehicle maintenance facility.

At the time of this IRMWP, all buildings on the eastern properties of OU-1 had been demolished and a portion is being utilized as a parking lot.

The Woodworth Ave Works former MGP Site is located within an industrial, commercial, storage and light manufacturing area that includes residences to the northeast and east. There has been a significant amount of property development in the vicinity of the Site.

1.2 Summary of Previous Investigation

The data discussed in the sections below are based on the sampling and findings, with regards to the eastern properties of OU-1, of the following documents reviewed by GEI:

- Remediation Services Engineering Report prepared by Ecosystems Strategies, Inc. dated 2002, 2003.
- Manufactured Gas Plant History Report, Woodworth Ave MGP Site prepared by RETEC Group, Inc. dated 2003.

- Site Characterization (SC) Report prepared by GEI dated between March and July 2019.

- Remedial Investigation (RI) Report prepared by GEI dated April 2022.

The locations of all samples referenced below are included in Fig. 2. Boring and monitoring well logs are included in Appendix A.

1.2.1 Subsurface Soil

MGP-impacted soils (sheen, staining, blebs, NAPL coating and/or saturation) were visually observed in the following borings on the eastern portion of OU-1:

- SB-102
- SB-105 through 110
- SB-124
- SB-207
- SB-220

Petroleum-impacted soils were generally limited to soil borings advanced on the southern parcel of the eastern portion of OU-1, adjacent Ashburton Avenue. Additionally, soil borings SB-105, SB-108, and SB-220 exhibited petroleum impacts comingled with MGP impacts.

Impacts in the following borings were limited to odors:

- SB-103
- SB-104
- SB-111
- SB-123
- SB-204

Borings SB-101, SB-125, SB-201, and SB-202 did not contain any visual or olfactory impacts. Borings SB-101, SB-201, and SB-202 bound the lateral extent of MGP-impacted soil at the northeast corner and eastern boundary of OU-1.

The source of the dense non-aqueous phase liquid (DNAPL) is primarily from the area of Gas Holder No. 2, which was converted into a subsurface tar tank c. 1917. The subsurface foundation of Gas Holder No. 2, constructed of brick and mortar, was found during the excavation of TP-102 and advancement of SB-108. The observed contents of Gas Holder No. 2 include NAPL staining, blebs, and saturated coal with fine to coarse sand and fine to coarse gravel. The remaining subsurface elements of the Gas Holder No. 2 are considered to be mostly intact due to the presence of tar and water within the holder.

NAPL impacts were observed in the borings located in the immediate area and downgradient of Holder No. 2 between 8.5 to 40 feet below ground surface (bgs). Based on the geologic stratigraphy observed in borings advanced in the vicinity of Holder No. 2/tar tank, the foundation appears to be near the till surface. At the time of this Work Plan, no boring has been advanced through foundation to evaluate the thickness of the holder foundation, the depth of the till surface below the holder, or the presence of impacts beneath the holder.

DNAPL from the holder appears to be present in the fill and sand above the till surface from Holder No. 2/tar tank to the west toward Alexander Street and south toward Ashburton Avenue. This former MGP structure appears to be the main source of DNAPL impacts on the eastern portion of OU-1 impacting soil and groundwater downgradient of Holder No. 2/tar tank.

In general, most soil borings advanced during the SC and RI had one or more samples that exceeded the Unrestricted and Industrial Use Soil Cleanup Objectives (SCOs) for volatile organic compounds (VOCs) and/or polycyclic aromatic hydrocarbons (PAHs). Samples collected during the SC at boring locations SB-105 and SB-108 exceeded the Industrial Use SCOs for some or all the BTEX (benzene, toluene, ethylbenzene, xylene) compounds. Maximum PAH concentrations were detected at soil boring location SB-108.

SB-105 contained the highest VOC concentrations, which was installed immediately adjacent to Holder No. 3. VOCs were detected exceeding SCOs in four of the five soil samples collected from boring including: SB-105 (2.5-3.0), SB-105 (9.0-9.5), SB-105 (24.0-25.0), and SB-105 (31.5-32.0). Total VOC concentrations exceeding Industrial Use SCOs were detected in SB-105 (2.5-3.0) at 76,930 mg/kg. During field investigation activities these shallow impacts were observed outside of a loading dock located at the 119 Woodworth Avenue property and was noted as being within historic fill and the material below that 2.5-3.0-foot interval is noted as having a solvent/ paint like odor. PAH concentrations for this 2.5-3.0-foot sample interval were considerably low but increased with depth. Based on field observation and analytical results, the shallow VOC exceedance in detected in SB-105 (2.5-3.0) do not appear to be MGP-related and are likely related to other, post-MGP operations at OU-1, potentially including the paint shop.

Soil sample SB-108 (18.5-19.0) was collected from the interval within the former holder, as confirmed by the excavation of the sub-grade holder wall in test pit TP-102. SB-108 (18.5-19.0) contained the second highest detection of total VOCs at 8,782 mg/kg. The total semi-volatile organic compounds (SVOC) concentration in this sample was 56,004 mg/kg. PAHs were the primary contributors to the total SVOC concentration, with concentrations of several PAHs in the sample exceeding Industrial Use SCOs. Based on field observations and analytical results from SB-108 (18.5-19.0), MGP-related residual impacts are present at the location of former Gas Holder No. 2/tar tank.

Metal exceedances above the Industrial Use SCOs were generally limited to soil samples collected within the shallow, urban fill interval. Metal exceedances were also compared to the Eastern United States and New England typical background concentrations, further discussed in the RI Report.

1.2.2 Groundwater

Groundwater flows west-southwest across the Site at low and high tides, towards the Hudson River. During the SC, VOCs and SVOCs were detected in the groundwater above New York State Ambient Water Quality Standards (NYS AWQS) on both the eastern and western portion of OU-1.

PAHs were detected in groundwater at all the monitoring wells on the eastern portion of OU-1 during the 2019 sampling event and at all wells except MW-101 (upgradient well) during the 2021 sampling event. The highest concentrations of total PAHs were detected MW-103 at 9,075 ug/L, which is located on the eastern portion of OU-1 downgradient from Gas Holder Nos. 2 and 3. The highest total BTEX concentrations were observed in MW-102 which is located downgradient of Gas Holder No. 1 and 3 and the former machine shop (operations post-date the MGP).

Concentrations of constituents of concern (COCs), including BTEX, isopropylbenzene, naphthalene and acenaphthene, were detected above the AWQS in MW-102 through MW-104, and MW-106 which are located adjacent to and downgradient from the former gas holders. PAH exceedances in these wells also correlated with observed impacts at these respective boring locations including NAPL coated and saturated soils.

Concentrations of chlorinated VOCs (trichloroethene, tetrachloroethene, 1,1,1-trichloroethane, cis- and trans-1,2-dichloroehtene, and styrene) were detected in MW-101, MW-102, MW-104. The highest concentrations of chlorinated VOCs were detected in centrally located well, MW-102, located downgradient of the former machine shop as well as in upgradient well, MW-101. Chlorinated VOCs area not associated with MGP operations and byproducts which suggests an upgradient source from either the former machine shop (operations post-date the MGP) and other upgradient, off-site sources.

DNAPL was observed in monitoring wells MW-102, MW-103, MW-105 on the eastern portion of OU-1. During the May 19, 2021 gauging event, DNAPL had an observed thickness ranging from 1.1 feet in MW-103 to a maximum of 2.5 feet in MW-105. Trace amounts (less than 0.1 feet) of light non-aqueous phase liquid (LNAPL) were also identified at monitoring well MW-102. Based on the results of the NAPL recovery testing performed during the SC, recoverable NAPL is present at only monitoring wells MW-105.

1.2.3 Soil Vapor

The SC and RI field work found that VOCs associated with MGP contamination are present in OU-1 soil vapor at levels consistent with background ambient air with the exception of elevated concentrations of chlorinated VOCs in two samples. Chlorinated VOCs are not associated with the former MGP.

2. Remedial Action Goals and Objectives

The remedial objectives, goals, cleanup standards, and guidance to be followed in performing this IRMWP are presented in the following sections.

2.1 Standards, Criteria, and Guidance

Standards, Criteria and Guidance values (SCGs) are defined in the 2010 NYSDEC Department of Environmental Remediation (DER)-10. Standards and criteria values are New York State regulations or statutes, which dictate cleanup standards. Guidance values are not legal requirements. They are values that are determined to be applicable to the Site and should be considered, based on professional judgment.

The following is a list of major SCGs that apply to the IRMWP:

- 6 NYCRR Part 375.
- DER-10 – Technical Guidance for Site Investigation and Remediation (May 2010).
- DER-10, Appendix 1A – NYSDOH General CAMP Requirements, Technical Guidance for the Site Investigations and Remediation.

2.2 Remedial Goal

The NYSDEC remedial program identifies the goal for site remediation under 6 NYCRR Sub-Part 375-2.8(a) as:

> "…restore that site to pre-disposal conditions, to the extent feasible. At a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by contaminants disposed at the Site through the proper application of scientific and engineering principles…"

The Remedial Goal of this IRM, therefore, is to remove or eliminate, to the extent feasible, identifiable sources of contamination, regardless of intended use of the Site or presumed risk.

3. Interim Remedial Measure Scope

The IRM will remove MGP source material on OU-1. The IRM conducted under this IRMWP will involve the following tasks:

- Removal, to the extent practicable, of MGP source material within the foundation of former Holder No. 2 to an estimated depth of 19 feet bgs.
- Document the interior condition of the holder following excavation and removal of impacted materials from inside the holder.
- Installation of Controlled Low Strength Material (Flowable Fill) beneath the groundwater table to maintain the structural integrity of the holder immediately following the removal of impacted source material.
- Backfill of the remainder of the holder with imported fill to the subgrade elevation and restoration of the asphalt surface to match existing conditions.
- Advancement of a soil boring to investigate the presence and magnitude of impacts beneath the holder foundation and installation of a recovery well if the presence of potentially recoverable product is observed in the boring.

3.1 Site Preparation

The Contractor will prepare OU-1 for the planned remediation. Where possible, the Contractor will utilize existing site controls such as existing fencing. Additional site preparation activities necessary to provide support for the soil excavation will include the establishment of work zones, decontamination facilities, and installation of temporary fencing/barriers around the work area. Temporary site facilities will include portable toilets, material storage, and equipment lay down areas.

The exclusion zone is the area within OU-1 where all worker activity is subject to the monitoring, work procedures, training, and protective equipment required in the attached Health and Safety Plan (HASP). For this project, the exclusion zone will include the excavation areas and any areas used to temporarily store, handle, or treat any of the MGP-impacted soil and groundwater removed from the excavation. The exclusion zone will be separately and clearly delineated from the rest of OU-1 and the perimeter security fencing.

The use of a Tensile Fabric Structure (TFS) was evaluated but is not anticipated to be utilized for this IRM due to limited space within and adjacent to the excavation limits. As depicted on Figure 3, the wall of Gas Holder 2 appears to extend up to the property line and existing

fence that runs North to South along Woodworth Avenue. Additionally, as shown on Figure 3, a utility pole and overhead utility lines are present approximately 5 feet from the existing fence in the vicinity of the proposed work area. The base of a TFS must be set outside of the proposed excavation limits so that the entire excavation can be completed under the TFS. In this case, the TFS base and wall required to cover the holder excavation and allow excavation to the anticipated depth along the sidewalk would extend through the overhead utility lines and poles. These limitations make the mobilization, usage, and demobilization of a TFS impracticable for the implementation of the IRM.

All personnel and equipment leaving the exclusion zone will be subject to the decontamination requirements described in Section 10 of this IRMWP. The Decontamination Plan, Section 10, details the placement and operation of the decontamination pads. Due to the limited available space at OU-1, sequencing of the work and changes in the locations of the work zones is anticipated.

Soil erosion and sediment control measures will be installed prior to excavation and maintained throughout the project, as appropriate. The Erosion and Sediment Control Plan, Section 8, details the appropriate sediment control measures.

3.2 MGP Source Material Excavation

Based on the results of the SC and RI, the source of DNAPL impacts on the eastern parcels of OU-1 appears to be the former Holder No. 2. MGP-impacted material will be removed from within the holder foundation to a target depth of the foundation floor at approximately 19 feet bgs, to the extent practicable. The excavation to remove MGP source material is estimated to be a total of approximately 1,400 cubic yards. Due to the proximity to and unknown structural load capacity of the retaining wall on the eastern parcels of OU-1, and the presence the railroad and overhead utilities, the use of traditional excavation support is not feasible to facilitate the removal of the holder structure and any potential impacted materials located beneath the holder floor. The groundwater table in the vicinity of the former holder foundation is approximately 10 feet bgs. General dewatering of the excavation is not anticipated to be performed during the Work. As the excavation progresses the holder wall will be exposed, cleaned of residual impacts via excavator bucket and inspected to document the interior condition. It is assumed that the holder wall and foundation is predominately intact, and limited groundwater infiltration will occur while excavating beneath the groundwater table, allowing the wall and foundation to be exposed, cleaned, and inspected. Limited dewatering may need to be performed to inspect the foundation and deeper sections of the holder wall. The holder foundation will then be backfilled to approximately one foot above the groundwater table with Controlled Low Strength Material (Flowable Fill). The installation of flowable fill within the holder to approximately one foot above the groundwater table will normalize hydrostatic pressure within and maintain the structural integrity of the vacated holder.

3.3 Confirmation Soil Boring

Following the removal of MGP source material from the holder and backfill to grade, a soil boring will be advanced through the holder bottom. The boring will confirm the thickness of the holder foundation, the depth to till below the holder foundation, and assess the presence and magnitude of any impacts located beneath the holder foundation. The boring will be advanced to 5 feet into the till surface or 10 feet deeper than visual impacts, whichever is deeper. If no visual impacts are noted beneath the holder foundation, the boring location will be abandoned via tremie grout to surface grade. If NAPL saturated soil is observed in the boring, a recovery well will be installed at the boring location to evaluate the potential for NAPL recovery. The well will be constructed with a PVC sump embedded in the till surface encased in a bentonite slurry and up to 10 feet of slotted well screen installed such that the bottom of the screen sits at the till surface for product collection and the top of the screen is set at the base of the holder foundation. The soil boring will be continuously logged, and field screened with a PID. A boring log will be developed to detail the geologic and visual impact observations and PID readings. Observations of the presence or absence of impacted soils the soil boring below the holder in will determine if additional remedial activities beneath Holder No. 2 will be required. Remediation of these materials, if required, will be address in the final remedy for OU-1.

3.4 Odor Control

To control odors during the excavation of MGP-impacted material, an odor control product, such as BioSolve® or Rusmar™ Foam will be employed. This material will be applied to the excavated areas, soil stockpiles, roll-offs, trucks, and containers as necessary to ensure that nuisance odors do not impact the local community. These odor control products will be readily available for use at the excavation and soil staging/stockpile areas at all times. The contractor will also employ additional physical barriers during excavation including covering open excavations or exposed soils after employing foam to further limit nuisance odors. As the use of a TFS to cover the excavation is not feasible, the contractor will be required to apply odor control measures continuously during excavation and soil handling. If necessary, multiple methods to control odors will be employed simultaneously to ensure that nuisance odors do not impact the local community.

3.5 Material Handling

Whenever possible, the excavation will be performed as a direct load operation to minimize the stockpiling of materials on Site. Any soil stockpiles created will be placed on liners and covered.

For soil transported from OU-1 in trucks, the bed will be lined, filled, covered with odor control foam, and appropriately covered with a tarp. The truck will then proceed to a

decontamination pad. Following decontamination, the truck will proceed directly to the Con Edison's designated disposal facility.

The Contractor will be responsible for collecting any disposal characterization sampling sufficient for acceptance at the chosen Con Edison-approved disposal facility.

If necessary, suspect materials encountered during excavation that may exhibit hazardous characteristics will be segregated, stored on-site, sampled, and disposed of appropriately.

3.6 Demarcation Barrier

Prior to backfilling the excavations, a visual demarcation barrier will be placed along the bottom and sides of the excavations by the Contractor. Within the holder foundation the demarcation barrier will be installed at the surface of the flowable fill to mark the base of the imported clean backfill material. The demarcation barrier will consist of a high visibility woven permeable geotextile or an equivalent system.

3.7 Backfill

The excavation will be backfilled with materials meeting the NYSDEC Part 375 Commercial Use Criteria. Compaction of placed backfill will be as specified in a project specification such that it is suitable for the final restoration. Following backfill, the surface will be restored to match the existing asphalt surface.

4. Permits

The Contractor will apply for and obtain all necessary Federal, State, and local permits associated with the IRMWP.

Specific permits that must be obtained from the City of Yonkers include:

- Stormwater Management Permit – Yonkers Engineering Department
- Permit for Excavation, Soil Removal, or Filling – Yonkers Building Department

As the work will commence once the Property Owner has completed selective demolition of existing site structures, a demolition of buildings permit will not be required for the IRM.

Other permits that may be required include, but are not limited to:

- Permits required for any off-Site parking that is negotiated between the Contractor and the City of Yonkers, Westchester County, and/or private parking facilities.
- Any other permits required to complete the Work.

5. Schedule

The milestone schedule for the IRM noted below is conceptual and subject to change based on site access, property owner construction, and other factors.

Interim Remedial Measure Work Plan	
Submit Draft IRMWP to NYSDEC	December 2022
NYSDEC Approve IRMWP Design (anticipated)	September 2023
Remedial Construction	
Contractor Procurement	September 2023 - December 2023
Contractor Obtain Local Permits/Preconstruction Submittals	December 2023 - March 2024
Contractor Mobilization	March 2024
Remediation Construction	March 2024 - April 2024
Construction Completion Report	
Submit Draft CCR to NYSDEC	July 2024
NYSDEC Approve CCR (anticipated)	September 2024

6. Site Restoration Plans

At the completion of the excavation activities, institutional and engineering controls will be established to govern future work at OU-1 which may encounter impacted materials. This will include maintenance of the soil cover system, periodic inspections, an environmental easement, and development of an ISMP.

6.1 Soil Cover System Maintenance

At the completion of the excavation and backfill activities, all disturbed areas will be paved to restore pre-IRM conditions.

6.2 Interim Site Management Plan

An Interim Site Management Plan (ISMP) was developed for OU-1 and OU-2 and submitted to the NYSDEC in December 2022. The ISMP includes an excavation work plan, HASP, Community Air Monitoring Plan (CAMP), and the requirements for future construction on the Site.

6.3 Post IRM Site Restrictions

As noted above, the ISMP will be in place for OU-1 to address any future work conducted between completion of the IRM and a final OU-1 remedy. At the completion of the IRM and any additional remediation required for OU-1 in the final remedy, a Site Management Plan and an environmental easement will likely be required for the OU-1 properties. We anticipate that the environmental easement will likely include the following restrictions, however, the final requirements will be included in the Decision Document for OU-1:

- Require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3).

- Allow the use and development of the controlled property for commercial and industrial as defined by Part 375-1.8(g), although land use is subject to local zoning laws.

- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or County DOH.

- Require compliance with a Department-approved SMP following final remediation.

7. Community Air Monitoring Plan

Intrusive activities at remediation sites typically generate airborne dust and vapors (VOCs) that have the potential to migrate off-site. In recognition of this potential hazard, the NYSDOH has promulgated a Community Air Monitoring Plan (CAMP) that establishes action levels of respirable dust and VOCs that are protective of the surrounding community. The requirements of the CAMP are contained in Appendix 1A of the 2010 Draft DER-10 Technical Guidance for the Site Investigations and Remediation. The CAMP is intended to supplement but be discrete from the air-monitoring program implemented by the Contractor for purposes of evaluating site worker health and safety.

7.1 CAMP Summary

A site-specific CAMP has been prepared for OU-1 and is included in Appendix B. The CAMP is designed to provide monitoring procedures, Alert Limits, Action Limits, and contingency measures if Action Limits are approached. An Alert Limit is a contaminant concentration or odor intensity that triggers contingent measures. An Alert Limit does not suggest the existence of a health hazard but serves instead as a screening tool to trigger contingent measures, if necessary, to assist in minimizing off-site transport of contaminants and odors during remedial activities. An Action Limit is a contaminant concentration or odor intensity that triggers work stoppage. In the event an Action Level has been exceeded, in accordance with the site-specific CAMP, Con Edison, NYSDEC, and NYSDOH will be notified immediately via phone, followed by email and the appropriate response actions will be deployed.

During times of ground intrusive activities, fixed air monitoring stations will be placed upwind and downwind of the work area. VOCs and respirable particulates (PM-10) will be monitored at the upwind and downwind stations on a continuous basis. Field monitoring data and a monitoring summary report will be submitted by email on a weekly basis. The CAMP includes a Contingency Plan that defines Alert Levels, Action Levels, and specific response activities to be implemented during working hours if an exceedance of an Alert Limit or Action Limit for a measured compound occurs. The response actions, potentially including work stoppage, are intended to prevent or significantly reduce the migration of airborne contaminants from OU-1.

If the real-time perimeter Action Limits are exceeded or significant nuisance odors are noted, Con Edison, the Engineer, and the Contractor will consult to determine what type of emission control action is appropriate. Actions that may be taken to reduce emissions include the following:

- Spraying water on exposed soil surfaces and/or roadways to suppress windblown dust.
- Covering working areas of exposed impacted soils, trucks loaded with impacts soils, or stockpiles of impacted soils with tarpaulins with vapor-suppressing foam or another vapor control agent.
- Temporarily relocating work to an area with potentially lower emission levels.
- Reduce the production rate or change the sequence of work activities.
- Change the work methods or equipment to alternatives that minimize air emissions.

In practice, these actions will typically be employed proactively to prevent action levels from being reached at the exclusion zone perimeter in the first instance. These above-mentioned Alert and Action Level Concentrations are included in the CAMP and will be summarized in the Contract Documents.

7.2 Fugitive Dust Control

Construction activities will be performed to limit the potential for fugitive dust emissions. Dust control measures will be implemented to minimize the potential for dust generation during soil excavation and handling, and placement of fill. Dust control measures will include water spraying, and/or suppressant foams. The Contractor will provide materials to act as a dust suppressant. This may include tarps and/or water, or chemical foam, (e.g., Rusmar™ Foam), or other Con Edison-approved methods. The Contractor will keep sufficient dust suppressant materials on site to suppress fugitive dust from the excavation. The material will be stored near the excavation and will be easily mobile in case of need.

Truck routes will be continuously monitored for excessive dirt or dust. Proper cleaning of trucks exiting the exclusion zone will aid in minimizing/eliminating dusty conditions on-site. A decontamination pad large enough to accommodate equipment and truck traffic will be constructed at exit points to clean tires of transport trucks exiting OU-1.

Transport trucks exiting the exclusion zone will pass through an inspection area and/or be inspected to ensure tires and undercarriages are clean and that tarps are secured. Excessive mud and loose dirt observed on the trucks will be manually removed with brooms, brushes, and water spray, as necessary.

7.3 Odor Control Plan

Construction activities will be performed in such a manner that limits the potential for nuisance odor emissions. All procedures typically used to limit or control MGP impacts to the surrounding community will be used proactively as needed. No work is expected to be conducted within 20 feet of occupied structures. Odor control measures will include the use of odor suppressant foams or solvents. The Contractor will provide materials to act as an odor suppressant. This may include chemical foam (e.g., Rusmar™ Foam), chemical solvents (e.g., BioSolve®) or other Con Edison-approved methods. The Contractor will keep sufficient odor suppressant materials on-site to suppress nuisance odors from open excavations, stockpiles, roll-off containers, or material transport vehicles. The odor suppressant materials and application equivalent will be readily available for use at the excavation and soil staging/stockpile areas at all times. The Contractor will apply odor-suppressing materials to the excavated materials as necessary when stockpiled, during excavation and loading operations, or at any other time and location as directed by Con Edison or NYSDEC to mitigate nuisance odors.

8. Erosion and Sediment Control Plan

The erosion and sediment controls are intended to mitigate erosion and sedimentation from OU-1 as indicated in the Contract Documents.

8.1 Description of Construction Activities

This project involves the excavation of approximately 1,400 cubic yards of MGP-impacted material. The excavation to remove MGP source material within Former Holder No. 2 will be performed to a depth of approximately 19 feet bgs. Dewatering is not anticipated so the work can be executed without compromising the holder foundation walls. Controlled Low Strength Material will be utilized beneath the groundwater table to equalize hydrostatic pressure within the holder and to solidify any residual impacts along the interior walls of the holder.

All storm water runoff from the exterior of the excavation area will be collected, routed, and discharged into the local drainage structures prior to contact with any impacted materials.

Access areas between the excavation area and the adjacent public streets will contain decontamination stations for all trucks and equipment. The decontamination waters will be collected and stored on-site in drums or a tank to be properly disposed of, as necessary.

8.2 Implementation of Erosion Control Measures

Sediment fence will be installed around the entire perimeter of the remediation including all areas to be excavated. Decontamination stations will act as anti-tracking pads, thereby removing all soil and sediment from all trucks/equipment wheels and bodies that are exiting OU-1 onto public streets. All trucks shall have watertight compartments to prevent seepage from wet soil from leaking onto public streets.

The Contractor shall install and maintain the erosion control measures indicated in the Contract Documents for the duration of the excavation work. Additional erosion control measures may be needed due to unforeseen conditions. The Contractor shall install additional measures as necessary and as directed by Con Edison.

8.3 Storm water Runoff Control

In preparation for and throughout the duration of the remedial activities, the control and diversion of storm water runoff is essential to reduce the potential for impacted material discharges off site. Storm water contact with the impacted soils will be limited due to the erosion and sediment control barriers around the area of excavation. Therefore, it is not

anticipated that runoff from the exterior will come in contact with the excavation area. The Contractor will be required to utilize appropriate control measures to route the runoff from the collection system to the municipal storm sewer. Storm water runoff control measures may include the installation of berms, barriers, and a sump for the collection and discharge of the water.

8.4 Restoration

Upon completion of the remedy, the contractor will remove all sediment fencing and restore the asphalt pavement surface to meet pre-IRM conditions. All sediment accumulated in the sediment fencing materials will be removed and transported to a properly licensed Con Edison-approved disposal facility.

9. Site Security Plan

The objectives of the security plan for the IRM are to prevent the vandalism/destruction of construction and equipment and to minimize health and safety concerns for the existing workers at the active facility during the work.

9.1 Perimeter Security

The Contractor will erect a temporary fence around the perimeter of each work area location. At a minimum, this will consist of temporary construction fencing, barriers, and lighting surrounding all work areas to include waste handling equipment, storage areas, excavation areas, and construction equipment. Where possible, the Contractor will utilize existing fencing. The fence will be secured at the end of each working day. Barriers or fencing extending onto or adjacent to site access roads shall be visible during day and evening hours.

9.2 Equipment Security

Unless otherwise restricted by the individual private property access agreements, all vehicles and/or equipment left in the work area must be secured at the end of each working day. In addition, vehicles and equipment must remain in a secure location overnight or during non-workdays. No vehicles or equipment may be left overnight in an unsecured location. It is the responsibility of the Contractor to ensure that all non-essential equipment is de-energized when left on-site and not in use to prevent electrical/fire/explosive hazards. No equipment will be run overnight and/or on non-working days.

The Contractor will make every effort to minimize the storage of equipment or materials in areas other than the specified storage area.

10. Decontamination Plan

The objectives of the decontamination plan for the IRM are to provide the procedures and equipment necessary to decontaminate personnel and equipment to prevent cross-contamination from the excavation area to public areas (i.e., highways, roads, support zones, vehicles, etc.). In the event that impacted materials are encountered, the decontamination procedures for personnel and equipment are outlined below. This plan does not replace the decontamination procedures outlined in the HASP, Appendix C. This plan provides additional guidelines on decontamination locations, necessary equipment, and procedures.

10.1 Decontamination Procedures

The Contractor will establish decontamination areas for the following activities.

- Personnel decontamination.
- Equipment decontamination.
- Vehicle decontamination.

10.1.1 On-site Personnel Decontamination

A personnel decontamination station where workers can drop equipment and remove personal protective equipment (PPE) will be set up at the boundary work zone within the work zone during remedial activities. It will be equipped with basins for water and detergent, and trash bags or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a final basin where they will wash themselves as a secondary means of personal hygiene (e.g., hands, face, etc.).

The specific decontamination procedures and requirements for the disposal of decontamination wastewater are outlined in the HASP and the Waste Management Plan **(**Section 11).

10.1.2 Equipment Decontamination

Hand tools and miscellaneous small equipment that come in contact with excavated soils or impacted groundwater will be decontaminated on a temporary decontamination pad in buckets of water and detergent.

A decontamination area will be established by the Contractor to clean equipment in accordance with the HASP. Potable water is not available at OU-1. Equipment that has been in contact with impacted soils will need to be cleaned with a pressure washer within the established off-site decontamination area. The decontamination pad will be sufficiently sized to ensure that the largest piece of Contractor equipment can be adequately decontaminated. Provisions will be made to control overspray at the decontamination pad.

All equipment leaving OU-1 will be decontaminated per these guidelines. In addition, any equipment previously utilized to excavate impacted material will be decontaminated prior to use in backfilling (e.g., excavator bucket).

Wastewaters produced during decontamination will be collected from the decontamination pad and transferred to on-site drums or a tank. The wastewaters will be characterized and properly disposed of by the Contractor. Disposal of the wastewater will be handled in accordance with the Waste Management Plan (Section 11).

Soils collected from the decontamination pads will be bulked with the excavated material and disposed of in accordance with the Waste Management Plan (Section 11).

10.1.3 Material Transport Vehicle Decontamination

Trucks transporting soil off site for ultimate disposal will enter OU-1 as described in the Traffic Control Plan. Care will be exercised when loading trucks not to spill material on the outside of the trucks. Before exiting OU-1, the Contractor will stage the trucks on the equipment decontamination pad. Trucks will then be visually inspected (i.e., box sidewalls, box tailgate, tires, etc.), cleaned and decontaminated as necessary prior to being allowed to leave OU-1. In addition, trucks will be required to be tarped prior to departing OU-1. All collected soil and decontamination fluids will be collected and managed in accordance with the Waste Management Plan (Section 11).

10.2 Decontamination Equipment

The Contractor will be responsible for maintaining a sufficient supply of equipment required to implement decontamination procedures, including, but not limited to, the following items:

- Plastic trash barrels.
- Liners for trash barrels.
- Wash basins.
- Alconox™ detergent concentrate.
- Hand pump sprayers.

- Long handled bristle brushes.
- Large sponges.
- Cleaning wipes for respirators.
- Bench or stool(s).
- Stepladder(s).
- Pressure washer/steam generator.
- Liquid detergent and paper towels.
- Plastic trash bags.
- Supplies/equipment to construct the decontamination pads.
- All necessary hosing, connections, etc. to collect and transport decontamination fluids.

11. Waste Management Plan

The objectives of the waste management plan at OU-1 are to provide the Contractor with the identification of waste streams to be generated for the proposed activities of this IRMWP and management/disposal guidelines for each waste stream. The Contractor will dispose of all waste materials generated as a result of these activities in accordance with all applicable laws and regulations at a Con Edison-approved disposal facility. The procedures outlined in this waste management plan will be followed for all derived wastes.

11.1 Disposal Record Keeping

All manifests and/or bills of lading for all shipments will be submitted to the Engineer prior to any vehicle departing OU-1. All manifests and/or bills of lading will be reviewed by the Engineer and signed by Con Edison or a designated Con Edison representative.

A log of all shipments and copies of all manifests and/or bills of lading will be maintained by the Engineer on-site for reference. Upon completion of the work, Con Edison will receive all logs and manifests and/or bills of lading. The logs, manifests, and bills of lading will be included in the Construction Completion Report (CCR) following completion of the proposed activities to create a permanent record of disposal.

11.2 Material Shipping Procedures

All material transportation vehicles leaving OU-1 must be watertight and will be decontaminated in accordance with the decontamination plan prior to departing OU-1. In addition, all vehicles transporting impacted soil from OU-1 must have lined beds to prevent leakage, bed covers, and watertight gates.

Individual waste streams will be handled as follows.

11.2.1 Non-Impacted Soils for Reuse

Excavated material from the proposed locations that is not impacted may be suitable for reuse as backfill beneath the cover system. Any excavated soils suitable for reuse that are not used to backfill will be transported off-site for disposal/landfill at an appropriately licensed Con Edison-approved disposal facility capable of handling such material.

11.2.2 MGP Impacted Soils and Bulky Waste

All excavated MGP-related material will be staged on a temporary stockpile until sufficient material is generated for a haul vehicle. The material from the stockpile will be placed

directly into haul vehicles and transported directly to an appropriately licensed Con Edison-approved disposal facility. The Contractor will have a primary and an alternate receiving facility prepared to receive the impacted soils prior to excavation.

Vehicles containing excavated soils will be covered with a solid plastic tarp. If necessary, spray-on odor suppressing materials such as Rusmar™ Foam or BioSolve® may be used to reduce potential naissance odors during transit.

Impacted soils that contain too high a water content to be transported safely (e.g., without risk of a liquid spill off-site) must be amended on-site within the excavation area, by the Contractor prior to shipment off-site. All amendments used at OU-1 will meet NYSDEC requirements.

11.2.3 Uncontaminated Bulky Waste

Uncontaminated bulky waste (i.e., asphalt pavement sections, concrete, and debris) will be separated, if possible, from impacted soil upon excavation, immediately placed in a roll-off container or temporarily placed in a stockpile for future loading and transported for disposal as construction debris at an appropriately licensed Con Edison-approved disposal facility.

The Contractor will not conduct on-site crushing of debris due to the limited space available, the potential for additional volatilization, and the generation of additional noise.

11.2.4 Impacted Groundwater and Decontamination Water

Contaminated liquids from decontamination of equipment and personnel will be pumped into drums or a frac tank(s) and disposed of off-site. The drums or tank(s) must be sufficiently sized to contain the wastewater. Tanks should provide some measure of primary treatment (settling) with weirs, baffles or other appropriate technology, and flow equalization, if needed.

The Contractor will arrange for the off-site disposal of all generated wastewater. The Contractor will retain a licensed liquid waste hauler to remove this liquid from OU-1 and properly dispose of this material in accordance with all applicable regulations. The Contractor will be responsible for obtaining any appropriate Federal, State, and/or local permits that may be required. The Contractor will have a primary and an alternate properly permitted, Con Edison-approved receiving facility prepared to receive all liquid wastes generated. In addition, the Contractor will ensure that off-site disposal and/or on-site storage volumes are adequate to avoid construction delays, if necessary.

Groundwater measurements from previous investigations indicate that the approximate depth to water in the excavation area ranged between 0.8 and 13.1 ft. bgs. Due to the depth to groundwater at OU-1, it is not anticipated that groundwater will be collected during

excavation. However, if impacted groundwater is collected, it will be containerized for off-site disposal.

Solid material collected in the frac tank(s) from settling will be bulked with the MGP-impacted soil and sent to an appropriately licensed Con Edison-approved disposal facility, as necessary.

11.3 Soil Disposal Characterization Analyses

The Contractor will coordinate with Con Edison and the property owner to collect any disposal characterization samples prior to the start of excavation activities. Any samples collected from impacted materials for disposal will be analyzed in accordance with the receiving facilities' guidelines and all Local, State, and Federal laws. The Contractor shall provide the Engineer the results of all analyses immediately upon receipt.

12. Sample Collection and Analysis Plan

The sample collection and analysis plan for the OU-1 IRM has been designed to support the requirements of the removal of MGP-impacted material. This plan describes the sampling and analysis procedures for collecting representative samples of backfill and wastewater for disposal.

All analytical testing will be performed by a laboratory that holds a current NYSDOH Environmental Laboratory Approval Program certification. A copy of the sampling data will be maintained on site by the Engineer during the remedial activities.

12.1 Representative Sampling of Backfill

The excavation will be backfilled with imported materials. The Contractor will identify the New York State Department of Transportation-approved and NYSDEC-permitted virgin borrow pit location(s) of imported material prior to the start of excavation activities. The Contractor will provide certificates of clean fill for the imported material identifying said material as native. In addition, the Contractor will provide analytical results from the borrow pit(s) for all import materials with greater than 10% by weight passing #10 sieve per DER-10 5.4(e), specific to the actual fill being imported to OU-1, as confirmation that the material is free of contamination. At a minimum, a sample of the backfill will be collected at the beginning, the middle, and the end of backfill operations. Backfill samples will be analyzed for full suite metals by United States Environmental Protection Agency (EPA) Method 6010, polychlorinated biphenyls by EPA Method 8082, VOCs by EPA Method 8260, or New York State Analytical Service Protocol (NYSASP) Method 95.1, SVOCs by EPA Method 8270C or NYSASP Method 95-2, and pesticides by EPA Method 8081. Samples will also be analyzed for PFAs via USEPA 1633 Method and compared with the DEC PFAS import guidance values. The required number of laboratory samples will follow DER-10 Table 5.4e (10). Samples will be analyzed and compared to Commercial Use Criteria listed in DER-10 Appendix 5.

12.2 MGP-Impacted Soils Sampling

MGP-impacted soils will be sampled by the Contractor in accordance with the conditions of the receiving facility for off-site disposal and the results provided to Con Edison and the Engineer.

12.3 Wastewater Sampling

Wastewater will be sampled by the Contractor in accordance with the conditions of the receiving facility for off-site disposal and the results provided to Con Edison and the Engineer.

13. Traffic Control Plan

A traffic management plan is provided in the Contract Documents which shows Site location, direction of traffic flow, and the location of flaggers or traffic control personnel as needed for trucks arriving and departing OU-1.

Traffic control personnel will be provided when all trucks are exiting onto Washington Avenue from OU-1. Traffic control personnel shall also direct traffic as needed upon delivery of equipment, etc., or during work performed in the road right-of-way in accordance with the applicable permit requirements. No trucks will be allowed to idle for longer than five minutes while at the work area location.

Truck Route Notes:

1. Do not queue trucks and equipment in local streets.
2. Do not idle trucks delivering materials or awaiting loading on OU-1 or on local streets.
3. Provide all necessary flagging for trucks entering/exiting OU-1.
4. Inform all authorities required as to the truck traffic and routes.
5. Follow approved local route to/from I-87.
6. Use only New York City Department of Transportation-approved through truck routes to exit New York City.

Directions Entering OU-1:

Heading North on Route 87:

1. Take Exit 10A for Yonkers Ave toward Mount Vernon (0.2 mi).
2. Turn left onto Mt Vernon Ave/Yonkers Ave (2.6 mi).
3. Turn right toward Ashburton Ave (161 ft).
4. Continue onto Ashburton Ave (1.2 mi).
5. Turn right onto Woodworth Ave, Destination on the left (98 ft).

Heading South on Route 87:

1. Take Exit 10B for Bronx River Rd toward Mount Vernon/Yonkers (233 ft).
2. Turn left onto Bronx River Rd (0.3 mi).

3. Turn right onto Yonkers Ave (2.6 mi).
4. Turn right toward Ashburton Ave (161 ft).
5. Continue onto Ashburton Ave (1.2 mi).
6. Turn right onto Woodworth Ave, Destination on the left (98 ft).

Directions Leaving OU-1:

To Points North:

1. Turn right onto out of OU-1 onto Woodworth Ave toward Ashburton Ave (98 ft).
2. Turn left onto Ashburton Ave (1.2 mi).
3. Turn left onto Yonkers Ave (2.6 mi).
4. Sharp left onto Bronx River Rd (499 ft).
5. Turn right onto Oak St (187 ft).
6. Turn left onto the Bronx River Pkwy N ramp (466 ft).
7. Merge onto Bronx River Pkwy.

To Points South:

1. Turn right onto out of OU-1 onto Woodworth Ave toward Ashburton Ave (98 ft).
2. Turn left onto Ashburton Ave (1.2 mi).
3. Turn left onto Yonkers Ave (2.2 mi).
4. Turn right onto Raybrook Rd (0.2 mi).
5. Turn right onto Bronx River Rd (0.4 mi).
6. Turn left to merge onto Bronx River Pkwy.

14. Construction Completion Report

Following the completion of OU-1 remedial activities, a CCR will be developed and stamped by an engineer licensed to practice in the State of New York. This report will include a summary of the field programs, documentation of any changes to the IRMWP, documentation of the final disposal of waste, contract drawings, specifications, and any approved changes to those documents.

Specific components of the Construction Completion Report will include:

- Record drawings, specifications, addenda, and approved changes.
- The actual volumes of excavated material and wastewater.
- Results of analytical samples collected during the implementation of the remediation.
- The summary of remaining impacts at the eastern portion of OU-1.
- Other plans and figures (if required), photographs, cross sections, data summary tables, and appendices that will provide NYSDEC with an accurate accounting of the remedial measures implemented at OU-1.
- Approval and Closure documents from the NYSDEC.
- Approved permits.
- Summary of construction work, meetings, and changes in work scope.
- Shipping manifests and bills of lading (contaminated soil, clean fill, and decontamination liquids).
- Summary of Air Monitoring Data collected during the remedial activities.
- Certification that material transported off-site was disposed of at a properly licensed Con Edison-approved disposal or treatment facility.
- "As-Built" survey drawings documenting the final site conditions prepared by a New York State-licensed land surveyor.

15. References

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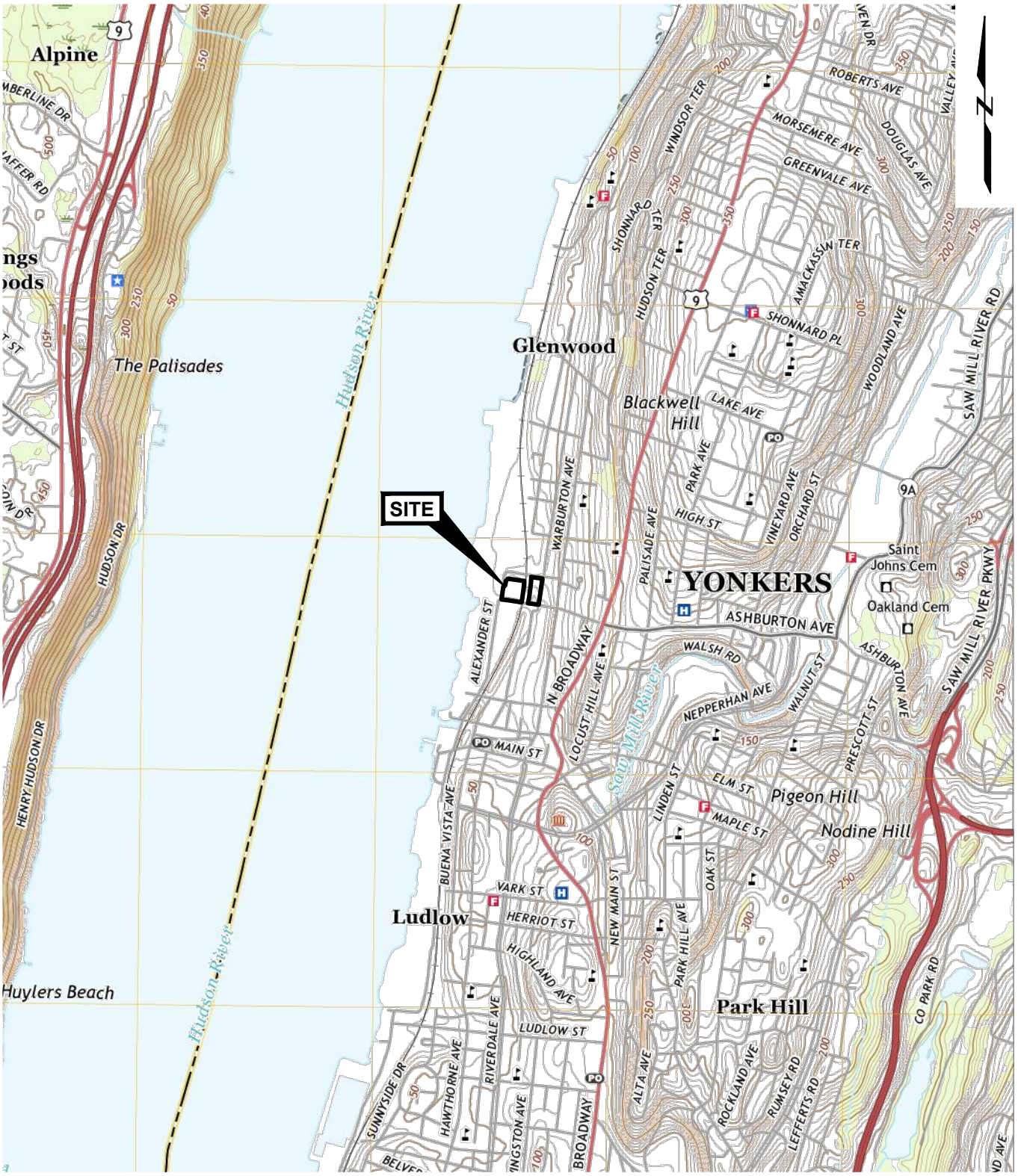
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New York State Department of Environmental Conservation (NYSDEC). *New York State Code of Rules and Regulations*, 6NYCRR Title 6, Chapter 100, Part 700-705.

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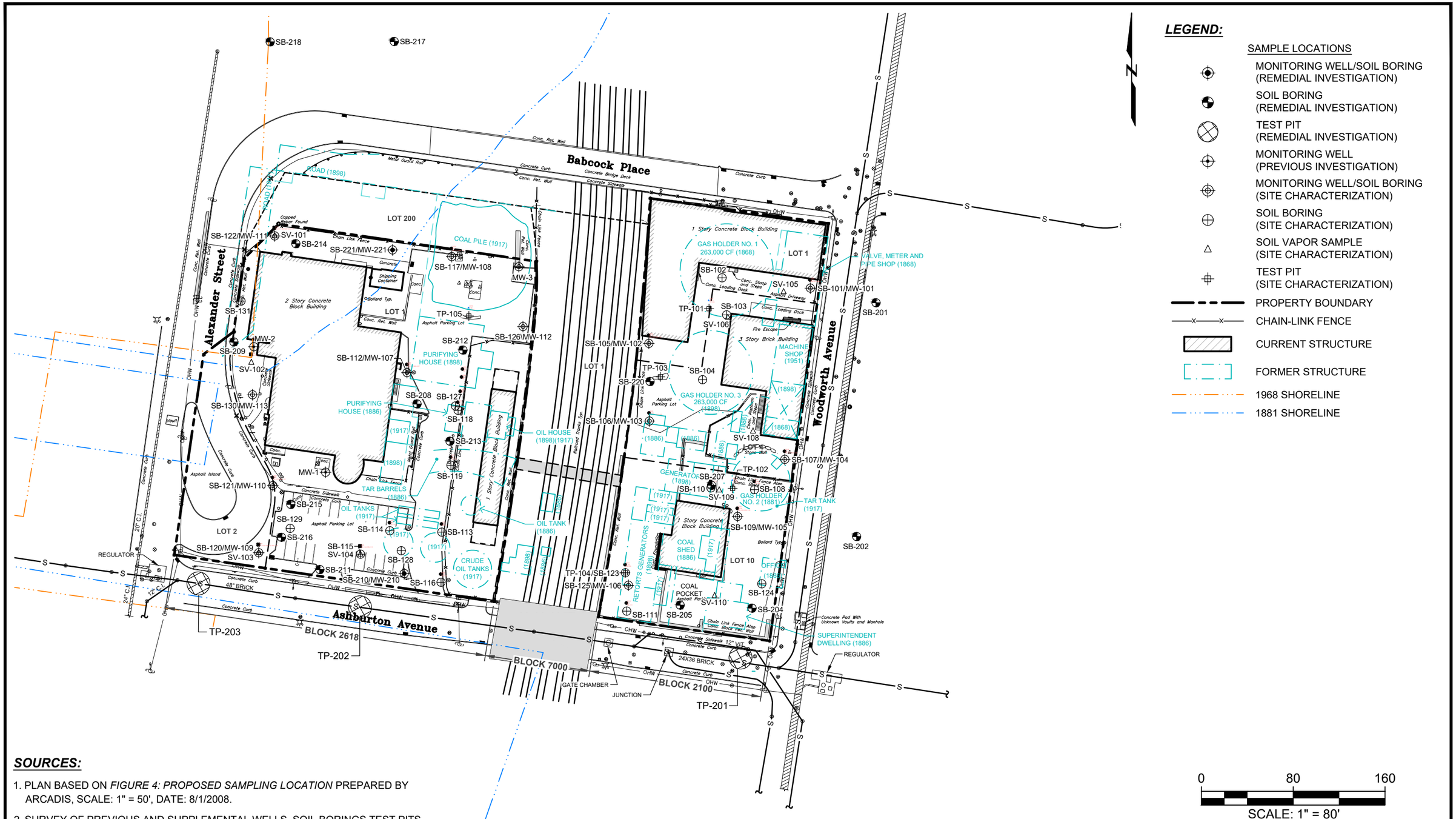
Figures



SOURCE:
MAP CREATED WITH YONKERS, NY, NJ QUADRANGLE
USGS TOPOGRAPHIC MAP, 7.5-MINUTE SERIES, 2019.

Interim Remedial Measure Work Plan Woodworth Ave MGP City of Yonkers, New York	GEI Consultants	SITE LOCATION MAP
Consolidated Edison Company of New York New York, New York	Project 2101005	July 2023 Fig. 1

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LEGEND:

SAMPLE LOCATIONS

- MONITORING WELL/SOIL BORING (REMEDIAL INVESTIGATION)
- SOIL BORING (REMEDIAL INVESTIGATION)
- TEST PIT (REMEDIAL INVESTIGATION)
- MONITORING WELL (PREVIOUS INVESTIGATION)
- MONITORING WELL/SOIL BORING (SITE CHARACTERIZATION)
- SOIL BORING (SITE CHARACTERIZATION)
- SOIL VAPOR SAMPLE (SITE CHARACTERIZATION)
- TEST PIT (SITE CHARACTERIZATION)
- PROPERTY BOUNDARY
- CHAIN-LINK FENCE
- CURRENT STRUCTURE
- FORMER STRUCTURE
- 1968 SHORELINE
- 1881 SHORELINE

SOURCES:

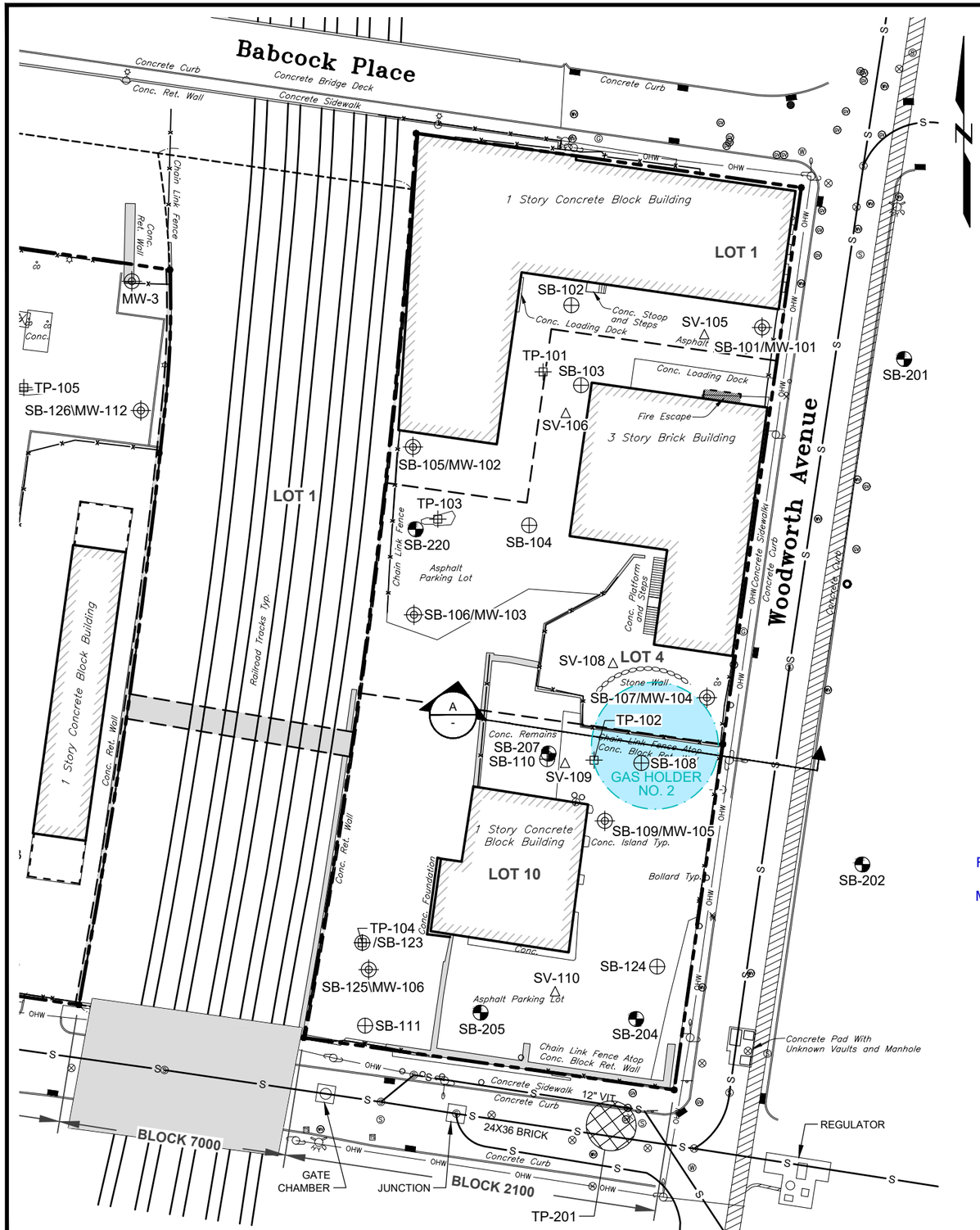
1. PLAN BASED ON *FIGURE 4: PROPOSED SAMPLING LOCATION* PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: 8/1/2008.
2. SURVEY OF PREVIOUS AND SUPPLEMENTAL WELLS, SOIL BORINGS TEST PITS AND SOIL VAPOR POINTS BASED ON *SHEET 1 OF 1: BOUNDARY SURVEY PREPARED FOR GEI CONSULTANTS,* PREPARED BY TEC LAND SURVEYING, SCALE: 1" = 30', DATE: 8/15/2019.
3. WORLD IMAGERY LAYER FROM ARCGIS.COM, SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

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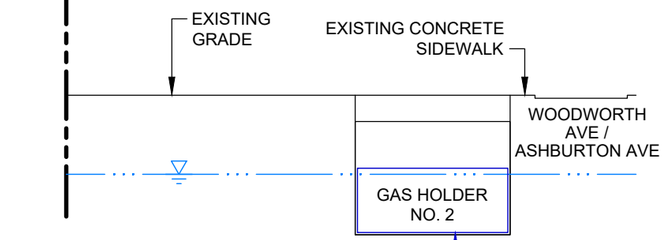
SCALE: 1" = 80'

Interim Remedial Measure Work Plan Woodworth Ave MGP City of Yonkers, New York	GEI Consultants	SITE LAYOUT AND EXPLORATION LOCATION PLAN
Consolidated Edison Company of New York New York, New York	Project 2101005	July 2023 Fig. 2

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EXISTING RETAINING WALL OR PROPERTY LINE



REMOVE, TO THE EXTENT PRACTICABLE, MGP SOURCE MATERIAL CONTAINED WITHIN THE FOUNDATION OF FORMER GAS HOLDER NO. 2. FILL THE HOLDER WITH CONTROLLED LOW STRENGTH MATERIAL (FLOWABLE FILL) TO 1 FOOT ABOVE THE GROUNDWATER TABLE ELEVATION. BACKFILL REMAINDER OF EXCAVATION WITH CLEAN FILL.

SECTION A - GENERIC EXCAVATION AND FILL DETAIL

NOT TO SCALE

LEGEND:

- MGP SOURCE MATERIAL EXCAVATION

SAMPLE LOCATIONS

- MONITORING WELL/SOIL BORING (REMEDIAL INVESTIGATION)
- SOIL BORING (REMEDIAL INVESTIGATION)
- TEST PIT (REMEDIAL INVESTIGATION)
- MONITORING WELL (PREVIOUS INVESTIGATION)
- MONITORING WELL/SOIL BORING (SITE CHARACTERIZATION)
- SOIL BORING (SITE CHARACTERIZATION)
- SOIL VAPOR SAMPLE (SITE CHARACTERIZATION)
- TEST PIT (SITE CHARACTERIZATION)
- PROPERTY BOUNDARY
- CHAIN-LINK FENCE
- CURRENT STRUCTURE

SOURCES:

1. PLAN BASED ON *FIGURE 4: PROPOSED SAMPLING LOCATION* PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: 8/1/2008.
2. SURVEY OF PREVIOUS AND SUPPLEMENTAL WELLS, SOIL BORINGS TEST PITS AND SOIL VAPOR POINTS BASED ON *SHEET 1 OF 1: BOUNDARY SURVEY PREPARED FOR GEI CONSULTANTS,* PREPARED BY TEC LAND SURVEYING, SCALE: 1" = 30', DATE: 8/15/2019.
3. WORLD IMAGERY LAYER FROM ARCGIS.COM, SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

0 50 100

SCALE: 1" = 50'

Interim Remedial Measure Work Plan Woodworth Ave MGP City of Yonkers, New York	GEI Consultants	INTERIM REMEDIAL MEASURE PLAN
Consolidated Edison Company of New York New York, New York	Project 2101005	July 2023 Fig. 3

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Appendix A

Boring and Monitoring Well Logs

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG
PAGE 1 of 2
SB-204

GROUND SURFACE ELEVATION (FT): 27.1
LOCATION: Auto Body Shop Woodworth Ave., Yonkers, NY
NORTHING: 768079.2672 **EASTING:** 658143.9411
TOTAL DEPTH (FT): 50.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: Jenny Light
DATE START / END: 4/21/2021 - 4/22/2021
DRILLING DETAILS: Sonic Coring
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	5	0.4, 0.2				G1A: (0-0.33) Asphalt G1B: (0.33-1.5') SWG: WIDELY GRADED GRAVELY SAND: 50% F-C sand, 40% gravel, up to 2", 10% non plastic fines, dark brown, dry. G1C: (1.5-2.6') SW: WIDELY GRADED SAND WITH GRAVEL: 60% F-C sand, 30% gravel, subrounded up to 2", 10% non plastic fines, brown, dry. Brick fragments present. G1D: (2.5-5') SW: WIDELY GRADED SAND WITH GRAVEL: 80% F-C sand (mostly m), 15% gravel, rounded up to 2", 5% non plastic fines, reddish-brown to brown, dry.
5	S2	5.0	3.3	0.3, 1.0, 0.6, 3.8, 2.1			SB-204(5-5.5)	S1A: (5-6.5') GWS: WIDELY GRADED SANDY GRAVEL: 50% gravel, up to 2", 40% F-C sand, 10% medium to low plastic fines, brown, saturated. S1B: (6.5-7.25') SW: WIDELY GRADED SAND WITH GRAVEL: 60% F-C sand (mostly m to f), 20% gravel up to 2", 10% medium to low plastic fines, brown, moist. S1C: (7.25-8') SW: WIDELY SAND WITH GRAVEL: 60% F-C sand (mostly m to f), 20% gravel, up to 2", 10% medium to low plastic fines, black, moist. Some coal fragments present. S1D: (8-9.5') SP: NARROWLY GRADED SAND: 85% F-M sand, 10% gravel with one rock, up to 3", 5% low to medium plastic fines, brown, dry. S1E: (9.5-10') CLS: SANDY CLAY: 90% medium plasticity fines, 10% C-F sand, brown, moist. S2A: (10-15.5') SM: SILTY SAND: 50% F sand, 50% low to medium plastic fines, reddish brown to tan, moist.
10	S3	10.0	7.5	3.7, 3.7, 2.3, 1.2, 2.2, 1.7, 5.3, 2.4, 1.2				
15								S2B: (15.5-17.25') SM: SILTY SAND: 50% F sand, 50% medium to low plastic fines, black to brownish gray. PLO present. S2C: (17.25-18.75') SP: NARROWLY GRADED SAND WITH GRAVEL: 80% C sand, 20% cobbles/rock up to 3", brown, wet. S2D: (18.75-20') SP-SM: NARROWLY GRADED SAND WITH SILT: 60% fine sand, 25% non-plastic fines, 15% gravel up to 1", brown, moist.
20	S4	10.0	8.5	0.2, 2.2, 2.3, 0.9, 11, 24.4, 24.6, 14.5, 3.7, 0.9				S3: (20-30') SW-SM: WIDELY GRADED SANDY SILT: 50% F-C sand (medium to fine), 30% non-plastic fines, 20% gravel up to 3", gray to brown, moist.

NOTES:

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ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG

SB-204

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
25								
30	S5	5.0	5.5	20.5, 0.5, 2.7, 7.8, 14.0, 8.2, 6.0, 6.1, 185.6				S4A: (30-35') SP-SM: NARROWLY GRADED SANDY SILT: 55% F-M sand (mostly F), 30% non-plastic fines, 15% gravel, brown to gray, moist.
35	S6	5.0	3.4	2.8, 3.2, 4.7, 9.4			SB-204 (34.5-35)	S4B: (35-35.2') SW-SM: WIDELY GRADED SAND WITH SILT 55% F-C sand, 30% non-plastic fines, 15% gravel, wet. Plastic like odor from bag. S5A: (35.2-36.9') SP: NARROWLY GRADED SAND WITH GRAVEL: 80% M-C sand, 15% gravel up to 3", 5% non-plastic fines, brown to gray, wet to moist. TILL. S5B: (36.9-40') SM: SILTY SAND: 50% F-M sand, 35% low to medium plasticity fines, 15% gravel, brown to gray, moist to wet. Similar plastic like odor from bag.
40	S7	5.0	4.5	4.1, 2.1, 2.3, 3.0, 8.6, 1.8, 3.0				S6A: (40-41') SP-SM: NARROWLY GRADED SILTY SAND WITH GRAVEL: 55% F-M sand, 35% non-plastic fines, 10% gravel, brown to gray, moist. Plastic like odor from bag. S6B: (41-42.5') BLDRCBBL: BOULDER AND COBBLE: pulverized rock and rock dust, gray, half wet and half dry. S6C: (42.5-45') SP-SM: NARROWLY GRADED SAND WITH SILT: 50% F-M sand (mostly fine), 30% low plasticity fines, 20% gravel up to 3", moist.
45	S8	5.0	2.6	2.0, 0.7, 5.3, 1.6				S7A: (45-46.3') SP-SM: NARROWLY GRADED SAND WITH SILT AND GRAVEL: 60% M-C sand, 20% gravel, 20% non-plastic fines, dark gray, wet. S7B: (46.3-48') SP-SM: NARROWLY GRADED SAND WITH SILT: 70% F-M sand, 20% non-plastic fines, 10% gravel, brown to gray, wet. S7C: (48.0-50.0'): BLDRCBBL: BOULDER AND COBBLE: pulverized rock.
50								Bottom of borehole at 50.0 feet. Soil Boring Terminated at Refusal

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG
PAGE 1 of 2
SB-205

GROUND SURFACE ELEVATION (FT): 27.2
LOCATION:
NORTHING: 768081.8437 **EASTING:** 658081.252
TOTAL DEPTH (FT): 50.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: Jenny Light
DATE START / END: 4/22/2021 - 4/23/2021
DRILLING DETAILS: Sonic Coring
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	G1	5.0	5.9	0.3, 0.4				G1A: (0-0.5') Asphalt G1B: (0.6-3.0') SWG: WIDELY GRADED GRAVELLY SAND: 50% F-C sand, 40% gravel up to 2", gravel angualr to rounded, 10% low to medium plasticity fines, brown, moist to dry.
5	S1	4.1	2.9	0.0, 2.7, 1.0, 0.0				G1C: (3.0-4.0') SW: WIDELY GRADED SAND WITH GRAVEL: 60% F-C sand, 30% gravel up to 2", gravel and asphalt/coal in apperance, 10% low plasticity fines, brown to dark gray, moist. G1D: (4.0-5.9') SW-SM: WIDELY GRADED SAND WITH SILT: 60% F-C sand (mostly M-F), 20% medium plasticity fines, 20% gravel, brown to light brown, moist. S1A: (5.9-6.6') ASPHALT: Asphalt, wet. S1B: (6.6-8.9') SW: WIDELY GRADED GRAVELLY SAND WITH GRAVEL: 40% F-C sand, 30% gravel, up to 3", 30% non-plastic fines, brown, wet. Sheen on standing water.
10	S2	10.0	3.2	8.5, 6.9, 0.9, 0.0, 2.7			SB-205 (10-11)	S1C: (8.9-10') SW: WIDELY GRADED GRAVELLY SAND WITH GRAVEL: 40% F-C sand, 30% gravel, up to 3", 30% silt, black, wet. Sheen on standing water. S2A: (10-13.2') SP-SM: NARROWLY GRADED SAND WITH SILT: 75% F-M sand, 15% non-plastic fines, 10% gravel to 1", medium brown, wet. Some black banding, PLO present, sheen present on grains and in water.
15								S2B: (13.2-17') SPG: NARROWLY GRADED GRAVELLY SAND WITH SILT: 65% F-M sand (some C sand), 20% gravel (angular to rounded 1", mostly 1/2"), 15% medium to low plastic fines, reddish brown, wet. S2C: (17-20') ML: SILT WITH SAND: 60% low plastic fines, 30% F-C sand, reddish brown, wet. PLO present, water has sheen and frothy consistancy at top.
20	S3	10.0	5	0.5, 1.3, 0.3, 0.8, 0.7, 2.1, 1.2, 1.0				S3A: (20-20.6') MLS: SANDY SILT: 40% non-plastic fines, 30% sand, 30% gravel angular up to 2", reddish brown to red, wet, sheen on standing water. S3B: (20.6-30') SP-SM: NARROWLY GRADED SAND WITH SILT: 75% F-M sand, 25% non-plastic fines, alternating layers of banded sands and fines, reddish brown to red, wet, sheen on standing water.

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

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CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG
PAGE 2 of 2
SB-205

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
25								
30	S4	10.0	5.8	1.2, 1.0, 0.6, 0.5, 0.5, 0.5, 0.9, 0.7, 1.0				S4: (30-40') SP: NARROWLY GRADED SAND WITH GRAVEL: 65% F-M sand, 20% gravel up to 2", 15% non plastic fines, reddish brown to brown, fining downwards.
35								
40	S5	10.0	7.5	1.8, 1.0, 0.8, 3.3, 1.3, 4.0, 42.9, 17.0, 4.0, 2.0				S5A: (40-42') SP: NARROWLY GRADED SAND: 90% M-C sand, 10% non-plastic fines, brown, wet. S5B: (42-46.75') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% F-M sand, 15% gravel, up to 2", 15% non-plastic fines, brown to gray, moist. Plastic like odor from bag.
45							SB-205(45-50)	
								S5C: (46.75-47-15): BOULDER COBBLE: pulverized rock layer, gray, dry. TILL. S5D: (47.15-50') SPG: NARROWLY GRADED GRAVELLY SAND WITH SILT: 65% F-M sand, 20% gravel, up to 2", 15% non-plastic fines, brown and gray, moist.
50								Bottom of borehole at 50.0 feet. Soil Boring Terminated at Refusal

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

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CLIENT: Con Edison
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CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG
PAGE 1 of 4
SB-207

GROUND SURFACE ELEVATION (FT): 28.3
LOCATION:
NORTHING: 768186.2106 **EASTING:** 658108.613
TOTAL DEPTH (FT): 93.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: Jenny Light
DATE START / END: 4/19/2021 - 4/21/2021
DRILLING DETAILS: Sonic Coring
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	G1	5.0	5	0.2, 0.1				G1: (0-5') SW: WIDELY GRADED SAND WITH GRAVEL: 70% F-C sand (mostly F-M), 20% gravel to 1", 10% low plasticity fines, brown, dry. Plastic, glass, and brick fragments present.
5	S1	10.0	8.1	0.3, 1.9, 1.2, 0.7, 1.6, 0.6, 3.9, 11, 124, 71, 216, 303				S1A: (5-7.6') SW: WIDELY GRADED SAND WITH GRAVEL: 70% F-C sand, 20% gravel (brick and rock to 2"), 10% non-plastic fines, brown. Trash and brick fragment present. S1B: (7.5-8') SW: WIDELY GRADED SAND WITH GRAVEL: 80% M-C sand, 20% gravel to 2", gray, dry. S1C: (8-10') SW-SM: WIDELY GRADED SAND WITH SILT: 80% F-C sand, 20% non-plastic fines, reddish brown to brown, dry.
10								S1D: (10-10.8') SWG: WIDELY GRADED GRAVELLY SAND: 60% F-C sand, 30% gravel to 1/4", 10% non-plastic fines, some brick, brown, dry. S1E: (10.8-11.6') MLS: SANDY SILT: 50% medium plasticity fines, 50% F-M sand, brown with black staining. S1F: (11.6-12.3') SP: NARROWLY GRAINED SAND: 90% F-M sand, 10% low plasticity fines, brown with black staining. S1G: (12.3-15') CH: HIGH PLASTIC CLAY: 90% medium to high plastic fines, 10% F sand, brown with black staining, noticable NAPL lense at 13.3 to 13.8'.
15	S2	10.0	9	374, 454, 554, 565, 369, 420, 313, 219, 160, 376, 695				S2A: (15-20') MLS: SANDY SILT: 50% F sand, 50% non-plastic fines, alternating fine sand and silt layers, sand layers have migrated NAPL, mostly coated lense, saturated lense at 16.3', 17.7', 18.6'.
20								S2B: (20-25') MLS: SANDY SILT: 50% F sand, 35% non-plastic fines, 15% gravel, alternating fine sand and silt, mostly coated lenses, some gravel at 23.1- 23.3', saturated NAPL lenses at 21', 24.1'.

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

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CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG

SB-207

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
25	S3	10.0	8.4	391, 225, 203, 56, 377, 147, 406, 568, 118, 81				S3A: (25-30') SW: WIDELY GRADED SAND WITH GRAVEL: 50% F-M sand, 30% gravel to 2", 20% non-plastic fines, mostly NAPL coated lens from 25-27 and 29.5-30'.
30								S3B: (30-35') SW-SM: WIDELY GRADED SAND WITH SILT: 70% F-M sand, 20% non-plastic fines, 10% gravel to 2", brown with black lenses, moist. NAPL coated lenses to 31.1', 31.3-32.1', and 33.6'.
35	S4	10.0	9	103, 364, 68, 24, 34, 15, 21, 13.9, 67, 3.2				S4A: (35-40') SW: WIDELY GRADED SAND WITH GRAVEL: 60% F-C sand, 30% gravel to 2", 10% non-plastic fines, brown to gray, dry to moist. Sheen observed at 37.0' NAPL coated coarse gravel up to 39.3'.
40								S4B: (40-45') SW: WIDELY GRADED SAND WITH GRAVEL: 70% F-C sand (mostly F-M), 25% gravel up to 2", 5% non-plastic fines, brown to light gray, moist.
45	S5	10.0	8	0.6, 0.6, 0.7, 4.1, 15, 25, 3.9, 5.5, 1.2			SB-207 (47.5-48)	S5A: (45-50') SP-SM: NARROWLY GRADED SAND WITH SILT: 70% F-M sand (some coarse), 20% non-plastic fines, 10% gravel up to 2", brown to gray, dry.
50								S5B: (50-53.45') SP-SM: NARROWLY GRADED SAND WITH SILT: 70% F-M sand, 20% non-plastic fines, 10% gravel up to 1", gray, moist. TILL.

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CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG
PAGE 3 of 4
SB-207

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
								S5C: (53.45-55') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% F-M sand, 30% gravel, gray, moist.
55	S6	10.0	10	0.6, 3.0, 2.1, 8.1, 2.5, 5.6, 0.5, 3.3, 7.6, 0.6, 4.1				S6A: (55-58.2') SP-SM: NARROWLY GRADED SAND WITH SILT: 75% F-M sand (some coarse), 15% non-plastic fines, 10% gravel, brown, moist.
								S6B: (58.2'-60') MLS: SANDY SILT: 60% non-plastic fines, 20% F-M sand, 10% gravel, gray to brown, dry.
60								S6C: (60-65') SP-SM: NARROWLY GRADED SAND WITH SILT: 75% F-M sand (some coarse), 15% non-plastic fines, 10% gravel, brown, moist.
65	S7	10.0	9.5	0.2, 0.9, 18.0, 38.9, 9.6, 2.0, 60.7, 6.6, 5.7, 50.3, 56.3				S7A: (65-70') SP-SM: NARROWLY GRADED SAND WITH SILT: 75% F-M sand (some coarse), 15% non-plastic fines, 10% gravel, brown, moist.
70								S7B: (70-75') SP-SM: NARROWLY GRADED SAND WITH SILT: 75% F-M sand (some coarse), 15% non-plastic fines, 10% gravel up to 1", gray to reddish brown, moist.
75	S8	10.0	8	17, 32, 4.5, 0.0, 2.4, 0.3, 4.7, 4.7, 7.5, 1.8				S8A: (75-80'): BOULDER AND COBBLES: pulverized rock, some silty sand with gravel, gray, very dry.
80								

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

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CITY/STATE: Yonkers, NY
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BORING LOG

SB-207

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
80								S8B: (80-83.6') SW: WIDELY GRADED SAND WITH GRAVEL: 70% F-C sand, 20% gravel up to 1", 10% non-plastic fines, moist.
								S8C: (83.6-85') MLS: SILTY SAND WITH GRAVEL: alternating silt and sand layers with gravel, some cobbles, brown sand layers, damp.
85	S9	8.0	5.5	2.4, 1.0, 4.7, 0.7				S9A: (85-85.8') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% F-M sand, 20% gravel, subrounded, 10% non-plastic fines, brown, moist. S9B: (85.8-87') SP: NARROWLY GRADED SAND: 95% M-C sand, 5% non-plastic fines, gray, moist. S9C: (87-87.6') GW: WIDELY GRADED GRAVEL WITH SAND: 75% rounded to angular gravel, 20% sand, 5% non-plastic fines, gray, moist. S9D: (87.6-90.0') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% F-M sand, 20% gravel, 10% non-plastic fines, brown, moist. S9E: (89.4-91.5') SM: SILTY SAND WITH GRAVEL: 50% F-M sand, 30% non-plastic fines, 20% gravel with 2 rock chunks, gray, moist. S9F: (91.5-93.0') BEDROCK: bedrock, appears to be grano-diorite.
90								Bottom of borehole at 93.0 feet. Soil Boring Terminated at Refusal (1.5 ft into bedrock)

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

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CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG
PAGE 1 of 5
SB-220

GROUND SURFACE ELEVATION (FT): 24.1 **LOCATION:**
NORTHING: 768276.5916 **EASTING:** 658055.0776 **TOTAL DEPTH (FT):** 120.00
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD83 NY East Zone
LOGGED BY: Jenny Light **DATE START / END:** 5/25/2021 - 5/27/2021
DRILLING DETAILS: Sonic Coring
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0								S1A (0.0-1.0) ASPHALT, black, dry. S1B (1.0-9.0') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% M-F sand, 15% gravel rounded to subangular up to 2", 15% non-plastic fines, black to brown, moist. Brick fragments present, staining present throughout, PLO like odor throughout.
5	S1	5.0	4.7	1200, 418.6, 505.9, 521.4, 157.3, 169.6				
10	S2	10.0	6.1	207.3, 381.2, 270.2, 369.4, 583.2, 945.1, 536.2, 661.3, 1037				S1C (9.0-10.0') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% M-F sand, 15% gravel rounded to subangular up to 2", 15% non-plastic fines, black to brown, moist. Brick fragments present, staining present throughout, PLO and VOC like odor throughout, NAPL coated lense at 9'. S2A (10.0-19.2') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% M-F sand, 15% gravel rounded to subangular up to 2", 15% non-plastic fines, black to brown, moist. Cobbles present. Sheen and NAPL coated grains from 15.2-20.0'. Wood present from 19.0-19.2'.
15								
20	S3	10.0	3.7	636.7, 648.7, 1588, 1126, 685.3, 386.5, 448.0, 227.1,			SB-220 (24-25)	S2B (15.8-20.0') SP: NARROWLY GRADED SAND WITH GRAVEL: 70% M-F sand, 15% gravel rounded to subangular up to 2", 15% non-plastic fines, black to brown, moist. NAPL coated. S3A (20.0-21.0') SP-SM: NARROWLY GRADED SAND WITH SILT: 65% F-M sand, 30% non-plastic fines, 5% gravel up to 1", reddish brown, wet. Sheen present. S3B (21.0-24.7') SP: NARROWLY GRADED SAND: 85% F-M sand, 10% gravel, 5% non-plastic fines, black staining. NAPL Coated lenses present from 21.4-21.9', and 23.7-24.6'.

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IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

GEI Consultants

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455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG

SB-220

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
25				25.6, 199.9				S3C (24.7-25.7') MLS: SANDY SILT: 50% non-plastic fines, 45% F sand, 5% gravel, rounded up to 1.5" reddish brown, moist. S3D (25.7-27.5') MLS: SANDY SILT: 50% non-plastic fines, 50% F sand, reddish brown, moist. S3E (27.5-30.0'): SP-SM: NARROWLY GRADED SAND WITH SILT: 70% F sand, 30% non-plastic fines, reddish brown, moist. Blebs and staining present from 27.5-28.6'.
30	S4	10.0	8.8	222.9, 177.2, 94.3, 37.1, 144.8, 18.7, 21.5, 30.8, 40, 55.9, 80.3				S4A (30.0-31.1') SP-SM: NARROWLY GRADED SAND WITH SILT: 60% F sand, 30% non-plastic fines, 10% gravel, brown, dry. S4B (31.1- 33.4') SP: NARROWLY GRADED SAND: 85% F sand, 15% non-plastic fines, reddish brown, wet, NAPL blebs present with sheen. S4C (33.4-40.0') SW-SM: WIDELY GRADED SAND WITH SILT AND WITH GRAVEL: 50% F-M sand, 30% non-plastic fines, 20%gravel and cobbles angular to rounded up to 5", brown, moist. TILL
35								
40	S5	10.0	7.3	18.5, 18.7, 28.7, 34.2, 12.2, 14.2, 16.2, 18.3, 16.3				S5 (40.0-50.0') SWG: WIDELY GRADED GRAVELLY SAND: 60%F-M sand, 30% gravel up to 2", 10% non-plastic fines, brown, dry, interbedded layers of sand and silt.
45								
50	S6	10.0	9.2	9.3, 1.0, 0.7, 0.7, 0.5, 0.1, 0.2, 0.5,				S6 (50.0-60.0') SP: NARROWLY GRADED SAND WITH GRAVEL: 50% F-M sand, 25% gravel and cobbles up to 2", 25% non-plastic fines, brown to gray, moist. Cobbles from 54.3-55' and from 57.8-58.3'.

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CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG

SB-220

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
55				2.6, 1, 0 .1, 0.1, 1.5				
60	S7	10.0	8.5	0.1, 0.2, 0.1, 0.1, 0.2, 0.2, 0.1, 0.1, 0.2, 0.2, 0.1, 0.3, 0.2, 0.3				S7 (60.0 - 70.0') SW: WIDELY GRADED SAND WITH GRAVEL: 50% F-M sand, 25% gravel rounded up to 2", 25% non-plastic fines, brown to gray, moist to dry, compact. Diorite in sample shoe.
65								
70	S8	10.0	9.2	4.5, 1.5, 4.3, 3.7, 0.9, 1.0, 1.5, 0.3, 0.4, 0.4, 4.9, 0.4, 0.2				S8A: (70.0-70.9') GW: WIDELY GRADED GRAVEL WITH SAND: 60% gravel up to 3", 20% F-M sand, 20% non-plastic fines, gray, wet. S8B (70.9-72.7') BOULDER/COBBLE: Rock: diorite, gray, pulverized. S8C (72.7-79.2') SW-SM: WIDELY GRADED SAND WITH SILT: 50% F-M sand, 30% non-plastic fines, 20% gravel up to 3", brown to gray.
75								
80								S8D (79.2-80.0') BOULDER/ COBBLE: Rock: diorite.

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

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PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 2101005

BORING LOG

SB-220

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
80	S9	10.0	10	0.3, 0.1, 0.3, 0.3, 0.2, 0.4, 0.4, 0.2, 0.5, 0.2, 0.2, 0.3, 0.7, 0.4, 0.2				S9 (80.0- 90.0') SW-SM: WIDELY GRADED SAND WITH SILT: 55% F-M sand, 25% non-plastic fines, 20% gravel, brown to gray. interbedded layers of sand and silt.
85								
90	S10	10.0	10	0.2, 0.5, 0.9, 0.2, 0.2, 0.3, 0.1, 0.2, 0.2, 0.1, 0.3, 0.1, 0.2, 0.2, 0.1, 0.6, 0.2, 0.6, 0.2				S10 (90.0-100.0') SW: WIDELY GRADED SAND WITH GRAVEL: 60% F-M sand, 25% gravel and cobbles up to 3", 15% non-plastic fines, brown to gray.
95								
100	S11	10.0	9.5	1.6, 3.6, 4.0, 5.8, 7.2, 4.5, 1.6, 1.5, 1.3, 1.3, 1.1, 4.8, 3.2, 3.1				S11 (100.0-110.0') SP: NARROWLY GRADED SAND WITH GRAVEL: 60% F sand, 25% gravel and cobbles up to 3", 15%non-plastic fines, brown to gray.
105								

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 3/11/22

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BORING LOG

SB-220

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
110	S12	10.0	9.8	1.0, 2.3, 3.7, 2.2, 2.7, 2.3, 1.4, 0.3, 1.3, 1.3, 3.6, 2.1			SB-220 (118-119)	S12A (110.0-113.5') SP: NARROWLY GRADED SAND WITH GRAVEL: 60% F-M sand, 30% subrounded gravel up to 2", 10% non-plastic fines, brown to gray-brown, moist.
								S12B (113.5-114') BOULDER/ COBBLE: Rock.
115								S12C (114.0-119.2') SP: NARROWLY GRADED SAND WITH GRAVEL: 60% F-M sand, 30% subrounded gravel up to 2", 10% non-plastic fines, brown to gray-brown, moist.
								S12D (119.2-120.0') GW: WIDELY GRADED GRAVEL: 100%gravel, angular up to 3", gray, wet.
120								Bottom of borehole at 120.0 feet.
								Soil Boring Terminated at Refusal (bedrock)

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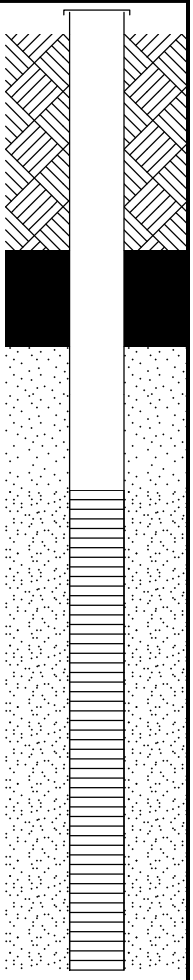
CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 2
SB-101/MW-101

GROUND SURFACE ELEVATION (FT): 35.774
LOCATION: 119 Woodworth Ave, Yonkers, NY
NORTHING: 768357.8895 **EASTING:** 658194.7032
TOTAL DEPTH (FT): 26.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/23/2019 - 4/24/2019
DRILLING DETAILS: Geoprobe/Hollow Stem Auger
WATER LEVEL DEPTHS (FT): ▼ 10.48 5/16/2019

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	5					(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
5	S2	5.0	1	7.3 6.6				(5'- 10') POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); moist, brown.
10 ▼	S3	5.0	1.5	1.5 3.0 2.3			SB-101 (9.5-10.0)	(10'- 15') POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); moist, brown.
15	S4	5.0	2.5	2.5 1.0 0.2 0.6 1.8 5.0			SB-101 (18.0-18.5)	(15'- 18.5') WELL GRADED SAND WITH SILT (SW-SM); moist, brown. (18.5' - 20.0') PEBBLES AND ROCK FRAGMENTS
20	S5	5.0	3	4.7 8.9 21.8 11.5				(20'- 25') POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); wet, brown.

WELL CONSTRUCTION DETAILS



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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG

SB-101/MW-101

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
25	S6	1.0	0	17.78			SB-101 (24.5-25.0)	(25'-26') NO RECOVERY	
								Refusal at 26.0 feet. Bottom of borehole at 26.0 feet. Soil Boring Terminated at Refusal (bedrock)	

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 1
SB-102

GROUND SURFACE ELEVATION (FT): 25.6846
LOCATION: 119 Woodworth Ave, Yonkers, NY
NORTHING: 768366.8567 **EASTING:** 658117.8109
TOTAL DEPTH (FT): 22.50
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/5/2019 - 4/5/2019
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
5	S2	5.0	0.3						(5'- 10') SANDY SILT WITH GRAVEL (ML); brown.
10		5.0	2.3	0.0 0.0 0.0 0.0 0.0 0.0					(10'- 15') SANDY SILT WITH GRAVEL (ML); brown.
15	S3	5.0	2	0.0 0.0 0.0 0.0 0.0				SB-102 (18.5-19.0)	(15'- 20') POORLY GRADED SAND WITH GRAVEL (SP); brown.
20	S4	2.5	1	0.0 0.5 0.9 9.6			NLO	SB-102 (22.0-22.5)	(20'- 22.5') SILT (ML); strong naphthalene-like odor, brown, sheen. Refusal at 22.5 feet. Bottom of borehole at 22.5 feet. Soil Boring Terminated at Refusal (bedrock)

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 1
SB-103

GROUND SURFACE ELEVATION (FT): 25.035
LOCATION: 119 Woodworth Ave, Yonkers, NY
NORTHING: 768334.6403 **EASTING:** 658121.7355
TOTAL DEPTH (FT): 20.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/5/2019 - 4/5/2019
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	2						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
				3.7					(4'- 4.5') SILTY SAND (SM); brown.
				15.0			NLO	SB-103 (4.5-5.0)	(4.5'- 5') SILTY SAND (SM); strong naphthalene-like odor, brown.
5	S2	5.0	1.5						(5'- 8') WELL GRADED SAND WITH SILT (SW-SM); brown.
				65					
				366					(8'- 10') SILT WITH SAND (ML); reddish brown, red brick (FILL).
				1155				SB-103 (9.5-10.0)	
10	S3	5.0	3						(10'- 15') SILT WITH SAND (ML); reddish brown.
				1007					
				926					
				147					
				103					
				97					
15	S4	5.0	4.5	379					(15'- 18') SILT WITH SAND (ML); reddish brown.
				356					
				105					
				350					(18'- 18.5') SILT (ML); brown.
				302				SB-103 (18.5-19.0)	(18.5' - 20.0') RED BRICK
				305					
20									Refusal at 20.0 feet. Bottom of borehole at 20.0 feet. Soil Boring Terminated at Refusal (bedrock)

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CITY/STATE: Yonkers, NY
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BORING LOG
PAGE 1 of 1
SB-104

GROUND SURFACE ELEVATION (FT): 24.8452
LOCATION: 119 Woodworth Ave, Yonkers, NY
NORTHING: 768278.1765 **EASTING:** 658100.8306
TOTAL DEPTH (FT): 17.50
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/5/2019 - 4/5/2019
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
5	S2	5.0	1	16.7					(5'- 9.5') SILTY SAND WITH GRAVEL; brown.
				23.2			NLO		(9.5'- 10') SILTY SAND WITH GRAVEL; slight naphthalene-like odor, brown.
10	S3	5.0	2						(10'- 14.5') SANDY SILT WITH GRAVEL; reddish brown.
				9.7				SB-104 (11.5-12.0)	
				3.2					
				4.7					
				3.1					
15	S4	2.5	2						(15'- 17') SANDY SILT WITH GRAVEL; brown.
				20.1					
				24.5					
				28.9				SB-104 (17.0-17.5)	(17.0' - 17.5') OLD / WORN CONCRETE Refusal at 17.5 feet. Bottom of borehole at 17.5 feet. Soil Boring Terminated at Refusal (possible holding tank)

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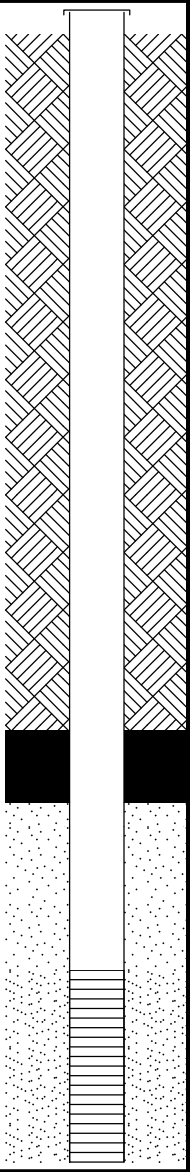
CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 2
SB-105/MW-102

GROUND SURFACE ELEVATION (FT): 24.7477 **LOCATION:** 119 Woodworth Ave, Yonkers, NY
NORTHING: 768309.7773 **EASTING:** 658054.0144 **TOTAL DEPTH (FT):** 32.00
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur **DATE START / END:** 4/8/2019 - 4/11/2019
DRILLING DETAILS: Geoprobe/Hollow Stem Auger
WATER LEVEL DEPTHS (FT): ▼ 13.64 5/16/2019

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
5	S2	5.0	2.5	515 544 240 1525 2547				SB-105 (9.0-9.5)	(5'- 8') SANDY SILT (ML); black, paint/solvent-like odor. (8'- 10') SANDY SILT (ML); black, paint/solvent-like odor.
10	S3	5.0	3	58.2 105 395 491 1010					(10'- 14') SILTY SAND (SM); brown black, sweet odor. (14'- 15') SILTY SAND (SM); brown black, sweet odor, stained at 14.5'.
15	S4	5.0	3.5	65 1167 2885 304 164 242				SB-105 (18.0-18.5)	(15'- 19.5') SILTY SAND (SM); brown black, sweet odor.
20	S5	5.0	4	871 105 164 107 381 351 277			NLO		(19.5'- 20') SILTY SAND (SM); brown black, NAPL blebs and staining, sweet odor. (20'- 24') SANDY SILT (ML); moderate naphthalene-like odor, brown black, NAPL sheen present at 21', sheen and blebs of NAPL at 21.5'.

WELL CONSTRUCTION DETAILS



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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 2 of 2
SB-105/MW-102

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
				588			NLO	SB-105 (24.0-24.5)	(24'- 24.5') SANDY SILT (ML); moderate naphthalene-like odor, brown black, solid NAPL.	
				1406			NLO		(24.5'- 25') SANDY SILT (ML); moderate naphthalene-like odor, brown black, staining, blebs.	
25	S6	5.0	3				NLO		(25'- 27') SANDY SILT (ML); strong naphthalene-like odor, brown black.	
				293			NLO		(27'- 28') SANDY SILT (ML); strong naphthalene-like odor, brown black, sheen, blebs.	
				175					(28'- 30') SANDY SILT (ML); strong naphthalene-like odor, brown black.	
				420			NLO		(30'- 32') SANDY SILT (ML); strong naphthalene-like odor, brown, blebs, stained.	
				346						
				314						
30				347						
	S7	2.0	1				NLO			
				77				SB-105 (31.5-32.0)	Refusal at 32.0 feet. Bottom of borehole at 32.0 feet. Soil Boring Terminated at Refusal (bedrock)	

NOTES:

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PID = PHOTOIONIZATION DETECTOR READING

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

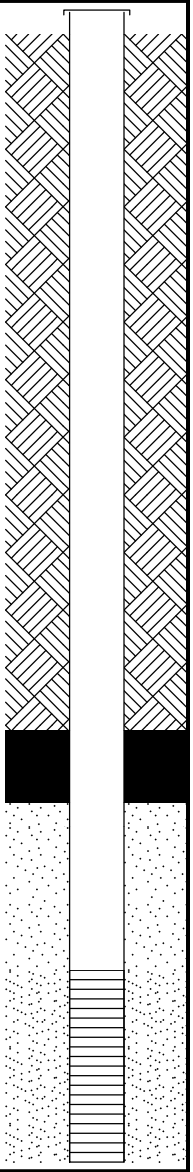
CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 2
SB-106/MW-103

GROUND SURFACE ELEVATION (FT): 23.3822
LOCATION: 119 Woodworth Ave, Yonkers, NY
NORTHING: 768242.1325 **EASTING:** 658054.4289
TOTAL DEPTH (FT): 32.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/8/2019 - 4/11/2019
DRILLING DETAILS: Geoprobe/Hollow Stem Auger
WATER LEVEL DEPTHS (FT): ▼ 13.14 5/16/2019

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
5	S2	5.0	3	0.0 0.0 2.1 1.7 1.8 0.7					(5'- 10') FILL SILTY SAND (SM); brown black, red brick.
10	S3	5.0	2	1.7 70.0					(10'- 14.8') POORLY GRADED SAND (SP); brown.
15	S4	5.0	4	374 1.0 10.3 34.1 207 346 413 190 319			NLO NLO NLO NLO		(14.8'- 15') SILTY SAND (SM); strong naphthalene-like odor, brown black. (15'- 17') SILTY SAND (SM); brown. (17'- 17.5') SILTY SAND WITH GRAVEL (SM); strong naphthalene-like odor, brown. (17.5'- 19') SILTY SAND WITH GRAVEL (SM); strong naphthalene-like odor, brown black, NAPL sheen present.
20	S5	5.0	3	47.0 10.7 98.0 178			NLO	SB-106 (21.0-21.5)	(19.5'- 20') SILTY SAND WITH GRAVEL (SM); strong naphthalene-like odor, brown black, NAPL blebs and coated grains. (20'- 24') POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM); strong naphthalene-like odor, brown, sheen.

WELL CONSTRUCTION DETAILS



NOTES:

PEN = PENETRATION LENGTH OF SAMPLER
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ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG

SB-106/MW-103

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
				283			NLO		(24'- 25') SILTY SAND WITH GRAVEL (SM); strong naphthalene-like odor, brown, NAPL blebs and coated grains.	
				348						
25	S6	5.0	4	345					(25'- 29') SILT (ML); strong naphthalene-like odor, brown, NAPL blebs and some coated grains. sheen.	
				570						
				825			NLO	SB-106 (26.5-27.0)		
				671						
				471						
				375						
				296						
				354			NLO		(29'- 30') SILT (ML); moderate naphthalene-like odor, reddish brown.	
				160						
30	S7	2.0	1						(30'- 31.5') SILTY SAND (SM); reddish brown.	
				77						
				67				SB-106 (31.5-32.0)	(31.5'- 32') SILTY SAND WITH GRAVEL (SM); reddish brown.	
									Refusal at 32.0 feet.	
									Bottom of borehole at 32.0 feet.	
									Soil Boring Terminated at Refusal (bedrock)	

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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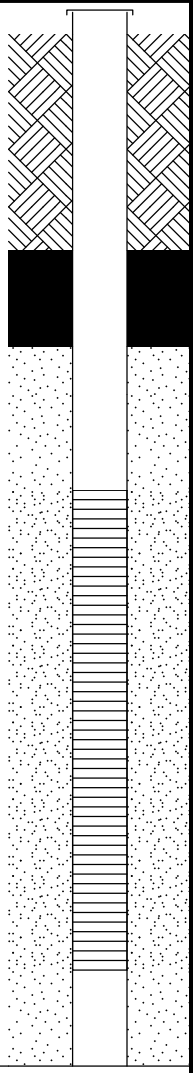
CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 1
SB-107/MW-104

GROUND SURFACE ELEVATION (FT): 32.1495
LOCATION: 115 Woodworth Ave, Yonkers, NY
NORTHING: 768208.7625 **EASTING:** 658172.4952
TOTAL DEPTH (FT): 22.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/12/2019 - 4/12/2019
DRILLING DETAILS: Geoprobe/Hollow Stem Auger
WATER LEVEL DEPTHS (FT): ▼ 9.11 5/16/2019

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
5	S2	5.0	4						(5'- 7') SANDY SILT WITH GRAVEL (ML); wet, brown.
				0.0					(7'- 7.5') SANDY SILT (ML); wet, brown.
				47.5					(7.5'- 8') SILT WITH SAND (ML); wet,
				136				SB-107(8.0-8.5)	brownish black.
▼				59			NLO		(8'- 8.5') SILT WITH SAND (ML); wet, reddish brown.
				35.9			NLO		
10				103.1					(8.5'- 9') SILT WITH SAND (ML); moderate naphthalene-like odor, wet, black, slight petroleum-like odor, stained.
	S3	5.0	2	44.5			NLO		(9'- 10') SILT WITH SAND (ML); slight naphthalene-like odor, wet, black, strong petroleum-like odor, partially NAPL coated.
				15.9					(10'- 13.5') SANDY SILT (ML); slight naphthalene-like odor, wet, blackish brown, strong petroleum-like odor, NAPL coated.
				42.7			NLO		
				133			NLO		
15				62.6					
	S4	5.0	4	137.9			NLO		(13.5'- 14') SANDY SILT (ML); moderate naphthalene-like odor, wet, blackish brown, NAPL coated.
				107					(14'- 15') SANDY SILT (ML); strong naphthalene-like odor, wet, blackish brown, NAPL coated.
				97					(15'- 18') SANDY SILT (ML); strong naphthalene-like odor, wet, blackish brown.
				171			NLO	SB-107 (18.0-18.5)	
				102					(18'- 20') SANDY SILT (ML); strong naphthalene-like odor, wet, blackish brown, fully NAPL-coated lens.
				167					
20				164					
	S5	2.0	1.5	207			NLO	SB-107 (20.5-21.0)	(20'- 22') SANDY SILT (ML); strong naphthalene-like odor, wet, blackish brown, NAPL-coated lens.
				98					
									Refusal at 22.0 feet. Bottom of borehole at 22.0 feet. Soil Boring Terminated at Refusal (bedrock)

WELL CONSTRUCTION DETAILS



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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 1
SB-108

GROUND SURFACE ELEVATION (FT): 28.8569
LOCATION: 95 Woodworth Ave, Yonkers, NY
NORTHING: 768182.4478 **EASTING:** 658146.0468
TOTAL DEPTH (FT): 19.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/9/2019 - 4/9/2019
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	1						(0'-0.5') ASPHALT (0.5'-7') HISTORICAL FILL
								SB-108 (2.0-2.5)	
5	S2	5.0	4	17.4					
				9.5			NLO		(6' - 8.5') COAL; strong petroleum-like odors, black.
				40					
				66			NLO		(8.5' - 10') COAL; thick substance, highly viscous, strong napthalene-like odor, black.
				266					
				135					
10	S3	5.0	3	394					(10' - 15') COAL; thick substance, highly viscous, strong napthalene-like odor, black.
							NLO		
				275					
				205					
				265					
				163					
15	S4	4.0	3	285					(15' - 17') COAL; thick substance, highly viscous, strong napthalene-like odor, black.
				257			NLO		
				320					(17' - 19') COAL; highly viscous, tar like, strong napthalene-like odor, black.
				380			NLO	SB-108 (18.5-19.0)	
									Refusal at 19.0 feet. Bottom of borehole at 19.0 feet. Soil Boring Terminated at Refusal (possible holding tank)

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FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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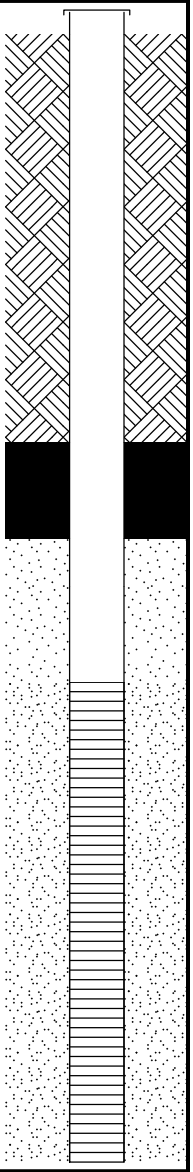
CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 2
SB-109/MW-105

GROUND SURFACE ELEVATION (FT): 28.3648
LOCATION: 95 Woodworth Ave, Yonkers, NY
NORTHING: 768159.0934 **EASTING:** 658131.3286
TOTAL DEPTH (FT): 30.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/10/2019 - 4/10/2019
DRILLING DETAILS: Geoprobe/Hollow Stem Auger
WATER LEVEL DEPTHS (FT): ▼ 11.61 5/16/2019

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL
5	S2	5.0	2.5	1.7 1.6 1.1 1.2 3.0					(5'- 10') SILT (ML); moist, reddish brown.
10	S3	5.0	3.5	1.2 2.0 1.4 6.1 19 22 195			NLO NLO NLO	SB-109 (13.5-14.0)	(10'- 12') SILT (ML); moist, reddish brown. (12'- 12.5') SILT (ML); moist, grayish brown. (12.5'- 13.5') SILT (ML); moderate naphthalene-like odor, moist, grayish brown. (13.5'- 14') SILT (ML); moderate naphthalene-like odor, moist, grayish brown, NAPL coated lens.
15	S4	5.0	4	220 180 249 325 101 87 297 109 374			NLO NLO NLO	SB-109 (17.0-17.5)	(14'- 14.5') SILT (ML); strong naphthalene-like odor, moist, grayish brown, NAPL coated lens. (14.5'- 15') WELL GRADED SAND WITH SILT (SW-SM); strong naphthalene-like odor, black, lightly NAPL coated. (15'- 17') WELL GRADED SAND (SW); strong naphthalene-like odor, black, NAPL coated.
20	S5	5.0	4	99 177 127 374 135 390			NLO NLO NLO		(17'- 18') SILT (ML); strong naphthalene-like odor, gray, stained, NAPL coated lens. (18'- 20') SILT (ML); strong naphthalene-like odor, gray, large NAPL coated lens. (20'- 21.5') SILT (ML); strong naphthalene-like odor, reddish brown,

WELL CONSTRUCTION DETAILS



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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG

SB-109/MW-105

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
25	S6	5.0	3.5	98 69 236 172 278 273 116 122 169 132			NLO NLO NLO NLO	SB-109 (29.5-30.0)	Stained. (21.5'- 22') SILT (ML); strong naphthalene-like odor, reddish brown, stained, NAPL coated sand lens. (22'- 22.5') WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); strong naphthalene-like odor, brown, Stained. (22.5'- 24') WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); strong naphthalene-like odor, brown, NAPL coated lens. (24'- 25') WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); strong naphthalene-like odor, brown, NAPL coated lens. (25'- 27') WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); strong naphthalene-like odor, grayish brown, Stained. (27'- 29') WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); strong naphthalene-like odor, grayish brown, NAPL coated lens. (29'- 30') WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); strong naphthalene-like odor, grayish brown, stained, NAPL coated lens. Refusal at 30.0 feet. Bottom of borehole at 30.0 feet. Soil Boring Terminated at Refusal	
30										

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 2
SB-110

GROUND SURFACE ELEVATION (FT): 28.4845 **LOCATION:** 95 Woodworth Ave, Yonkers, NY
NORTHING: 768183.9881 **EASTING:** 658108.0699 **TOTAL DEPTH (FT):** 27.50
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur **DATE START / END:** 4/10/2019 - 4/10/2019
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'-0.5') CONCRETE (0.5'-5') HISTORICAL FILL
5	S2	5.0	3	0.0 0.0 0.0 0.0 0.0 0.0			NLO		(5'- 7.5') SILTY SAND WITH GRAVEL (SM); brown. (7.5'- 8.5') SILTY SAND WITH GRAVEL (SM); wet, brown. (8.5'- 9') White rock. (9'- 10') SANDY SILT (ML); slight naphthalene-like odor, moist, blackish brown.
10	S3	5.0	4	0.8 0.2 14.8 34.3 54.4 104 0.4			NLO NLO NLO		(10'- 12') SANDY SILT WITH GRAVEL (ML); slight naphthalene-like odor, moist, blackish brown. (12'- 12.5') SANDY SILT (ML); slight naphthalene-like odor, moist, reddish brown. (12.5'- 15') SILTY SAND (SM); strong naphthalene-like odor, moist, brown, Staining.
15	S4	5.0	5	166 99.8 277 335 245 98 315 219 259			NLO NLO NLO NLO NLO	SB-110 (16.0-16.5)	(15'- 16') SILT (ML); strong naphthalene-like odor, moist, brown, Staining. (16'- 18.5') SILT (ML); strong naphthalene-like odor, moist, brown, stained, NAPL-coated lens / NAPL coated. (18.5'- 19') SILTY SAND (SM); strong naphthalene-like odor, moist, brownish black, NAPL saturated. (19'- 19.5') SILT (ML); strong naphthalene-like odor, moist, brown, NAPL coated.
20	S5	5.0	3	379 75 45			NLO NLO	SB-110 (19.5-20.0)	(19.5'- 20') SANDY SILT (ML); strong naphthalene-like odor, moist, brown, NAPL coated. (20'- 23') SILT (ML); strong naphthalene-like odor, moist, brown, NAPL coated. (23'- 24') SILT (ML); strong naphthalene-like odor, wet, reddish, NAPL coated lenses and blebs.

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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG

SB-110

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				64					(24'- 25') SILT (ML); strong naphthalene-like odor, wet, reddish, NAPL stained.
				39			NLO		
25	S6	2.5	2.5	68					(25'- 27') SILTY SAND WITH GRAVEL (SM); strong naphthalene-like odor, moist, reddish brown, NAPL stained, NAPL coated lenses.
				35					
				280			NLO		
				293					
				205			NLO	SB-110 (27.0-27.5)	(27'- 27.5') SILTY SAND WITH GRAVEL (SM); strong naphthalene-like odor, moist, reddish brown, NAPL stained, NAPL coated lenses.
				288					Refusal at 27.5 feet.
									Bottom of borehole at 27.5 feet.
									Soil Boring Terminated at Refusal (bedrock)

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ppm = PARTS PER MILLION
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ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

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CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 1
SB-111

GROUND SURFACE ELEVATION (FT): 8.1105
LOCATION: 95 Woodworth Ave, Yonkers, NY
NORTHING: 768076.6105 **EASTING:** 658034.7101
TOTAL DEPTH (FT): 5.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/15/2019 - 4/15/2019
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	1.5				PLO		(0'-3.5') HISTORICAL FILL; strong petroleum-like odor, brown.
							PLO		(3.5'-4') HARD ROCK; strong petroleum-like odor, brown.
				16.8			PLO		(4'- 4.5') WELL GRADED GRAVEL WITH SAND (GW); strong petroleum-like odor, wet, brownish black.
5				290			PLO	SB-111 (4.5-5.0)	(4.5'- 5') SILTY SAND (SM); strong petroleum-like odor, moist, brown.
				289					Refusal at 5.0 feet.
									Bottom of borehole at 5.0 feet.
									Soil Boring Terminated at Refusal

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING
ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG

PAGE 1 of 1

SB-123

GROUND SURFACE ELEVATION (FT): 10.3943
LOCATION: 95 Woodworth Ave, Yonkers, NY
NORTHING: 768110.0461 **EASTING:** 658033.5736
TOTAL DEPTH (FT): 7.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 4/15/2019 - 4/15/2019
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	5.0	0						(0'- 5') FILL.
5	S2	2.0	2	0.0 0.7 3.9 12.1 18			PLO	SB-123 (6.5-7.0)	(5'- 7') FILL; strong petroleum-like odor, red, red brick fragments. Refusal at 7.0 feet. Bottom of borehole at 7.0 feet. Terminated at Refusal (Red Bricks)

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING
ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 2
SB-124

GROUND SURFACE ELEVATION (FT): 27.381
LOCATION: 95 Woodworth Ave, Yonkers, NY
NORTHING: 768100.4175 **EASTING:** 658152.409
TOTAL DEPTH (FT): 35.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 6/21/2019 - 6/21/2019
DRILLING DETAILS: Sonic Coring
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	10.0	8						(0'-0.5') ASPHALT (0.5'-5') HISTORICAL FILL; slight petroleum-like odor
				25.7			PLO		
5				89				SB-124 (4.5-5.0)	(5'- 9') SILT WITH SAND (ML); slight naphthalene-like odor, gray.
							NLO		
				24.7					
				23.4				SB-124 (9.0-9.5)	(9'- 12') SILT WITH SAND (ML); strong naphthalene-like odor, gray, NAPL coated grains.
10	S2	10.0	4	27			NLO		
				26			NLO		(12'- 13') WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); moderate naphthalene-like odor, red.
				160			NLO		(13'- 14') SILT WITH SAND (ML); moderate naphthalene-like odor, reddish gray, NAPL stained lenses.
				107			NLO		(14'- 14.5') FAT CLAY (CH); slight naphthalene-like odor, gray.
15				10					(14.5'- 15') SILT WITH SAND (ML); black gray.
				0.0					(15'- 16') SILT WITH SAND (ML); brownish gray.
				4.3					
				0.0					(16'- 17') WELL GRADED SAND (SW); brown.
				0.0					
				0.0					(17'- 20') WELL GRADED SAND WITH GRAVEL (SW); brown.
				0.0					
				0.0					
				0.0					
				0.0					
20	S3	5.0	0						(20'-25') NO RECOVERY

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING
ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG

SB-124

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
25	S4	10.0	10	36					(25'- 31') WELL GRADED SAND WITH GRAVEL (SW); gray.
				9.7					
				0.4					
				11.4					
				0.0					
				0.0					
				0.0					
				0.0					
30				0.0					
				18					(31'- 35') WELL GRADED SAND WITH GRAVEL (SW); gray brown.
				32					
				5					
				0.0				SB-124 (34.0-34.5)	
35				0.0					

Refusal at 35.0 feet.
Bottom of borehole at 35.0 feet.
Soil Boring Terminated at Refusal (bedrock)

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

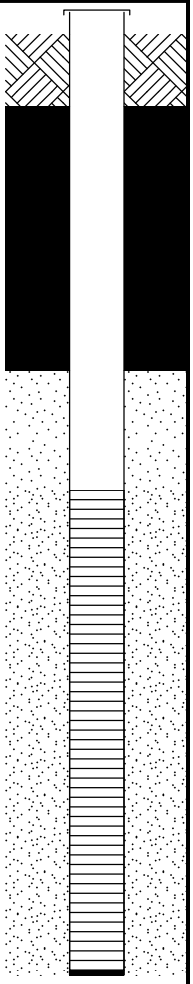
CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG
PAGE 1 of 2
SB-125/MW-106

GROUND SURFACE ELEVATION (FT): 10.005
LOCATION: 95 Woodworth Ave, Yonkers, NY
NORTHING: 768104.065 **EASTING:** 658038.522
TOTAL DEPTH (FT): 35.00
DRILLED BY: ADT
DATUM VERT. / HORZ.: NAVD 88 / NAD83 NY East Zone
LOGGED BY: M. Sandefur
DATE START / END: 6/21/2019 - 6/21/2019
DRILLING DETAILS: Sonic Coring
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0	S1	10.0	10					(0'- 5') FILL.
5							SB-125 (4.5-5.0)	(5'- 9') CONCRETE; rock / concrete, some wood present ~6'.
10								(9'-10') NO RECOVERY
	S2	10.0	4					(10'- 17') WELL GRADED SAND WITH SILT (SW-SM); gray.
15				0.0				
				0.0				(17'- 18') WELL GRADED SAND WITH SILT (SW-SM); reddish.
				0.0				(18'- 20') SILT WITH SAND (ML); reddish.
				0.0				
20	S3	5.0	0	0.0			SB-125 (19.5-20.0)	(20'-25') NO RECOVERY

WELL CONSTRUCTION DETAILS



NOTES:

PEN = PENETRATION LENGTH OF SAMPLER
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING
ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants

GEI Consultants, Inc., P.C.
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT: Con Edison
PROJECT: Woodworth Ave MGP - Con Edison
CITY/STATE: Yonkers, NY
GEI PROJECT NUMBER: 1900674

BORING LOG

SB-125/MW-106

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
25	S4	10.0	10	0.0				(25'- 35') WELL GRADED SAND WITH GRAVEL (SW); gray.	
				0.0					
				0.0					
				0.0					
				0.0					
30				0.0					
				0.0					
				0.0					
				0.0			SB-125 (33.0-33.5)		
				0.0					
35				0.0					
								Refusal at 35.0 feet.	
								Bottom of borehole at 35.0 feet.	
								Soil Boring Terminated at Refusal (bedrock)	

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG WOODWORTH AVE - CON ED BORING LOGS.GPJ GEI CONSULTANTS.GDT 11/27/19

GEI Consultants GEI Consultants, Inc. 455 Winding Brook Drive Glastonbury, CT 06033 (860) 368-5300	**CLIENT:** Con- Ed	**TEST PIT LOG**	
	PROJECT: Woodworth Avenue Former MGP	**PAGE** 1	**TP-104**
	CITY/STATE: Yonkers, NY		
	GEI PROJECT NUMBER: 1900674		

GROUND SURFACE ELEVATION (FT):		**LOCATION:**	See Plan
NORTHING:	**EASTING:**	**TOTAL DEPTH:**	5.0 Feet
OBSERVED BY:	M. Sandfeur	**TOTAL LENGTH:**	4.0 Feet
CHECKED BY:	J. Parillo	**TOTAL WIDTH:**	2.0 Feet
EQUIPMENT:	Excavator: Bobcat E35	**DATUM VERT. / HORZ.:**	
WEATHER:	65° F Overcast	**DATE START / END**	4/1/2019- 4/2/2019

DEPTH FT.	ANALYZED SAMPLE ID	SOIL DESCRIPTION
1		
2		(0.0-5.0') Fill, hard rock, F-C sand and Gravel with Silt, Strong Petroleum like odor
3		
4		
5		Groundwater encountered at 4.5 feet.
6		
7		
8		
9		
10		

Bottom of test pit at 5.0 feet. Backfilled and concrete patched.

NOTES:

IN. = INCHES

FT. = FEET

GEI Consultants, Inc. 455 Winding Brook Drive Glastonbury, CT 06033 (860) 368-5300	**CLIENT: Con- Ed**	**TEST PIT LOG**	
	PROJECT: Woodworth Avenue Former MGP	**PAGE**	**TP-104**
	CITY/STATE: Yonkers, NY	1	
	GEI PROJECT NUMBER: 1900674		

GROUND SURFACE ELEVATION (FT):		**LOCATION:**	See Plan
NORTHING:	**EASTING:**	**TOTAL DEPTH:**	5.0 Feet
OBSERVED BY:	M. Sandfeur	**TOTAL LENGTH:**	3.0 Feet
CHECKED BY:	J. Parillo	**TOTAL WIDTH:**	2.0 Feet
EQUIPMENT:	Excavator: Bobcat E35	**DATUM VERT. / HORZ.:**	
WEATHER:	65° F Overcast	**DATE START / END**	4/1/2019- 4/2/2019

Photographic Log



Bottom of test pit at 5.0 feet.

Picture showing soil strata at Test pit 4

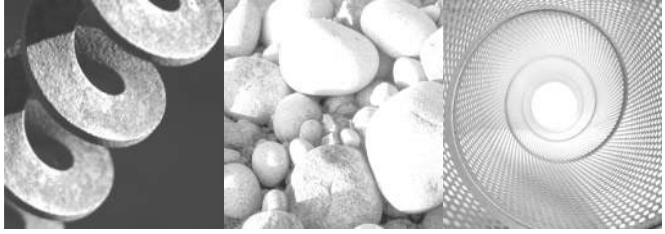
NOTES:

IN. = INCHES

FT. = FEET

Appendix B

Community Air Monitoring Plan



GEI Consultants

Consulting
Engineers and
Scientists

Community Air Monitoring Plan

Woodworth Avenue Works – Former MGP Site

Yonkers, Westchester County, New York
Site ID: 360164

Submitted to:
Consolidated Edison Company of New York
31-01 20th Avenue
Long Island City, NY 11105

Submitted by:
GEI Consultants, Inc., P.C.
455 Winding Brook Drive, Suite 201
Glastonbury, CT 06033
860-368-5300

April 2023
Project 2101005



Melissa J. Felter, P.G., LEP
Project Manager

Matthew J. O'Neil, P.E.
Vice President, Senior Engineer

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A. NYSDOH Generic CAMP from DER-10 Appendix 1A

JT/MO/JG:bdp

\\geiconsultants.com\Data\Data_Storage\Working\CON ED\1900674 Former Woodworth Ave MGP Site\01_ADMIN\IRM Work Plan\Appendix B CAMP\CAMP.360164.2023-004-17.docx

Abbreviations and Acronyms

CAMP	Community Air-Monitoring Plan
Con Edison	The Consolidated Edison Company of New York, Inc.
DER-10	[Division of Environmental Remediation]-10, Technical Guidance for Site Investigation and Remediation
GEI	GEI Consultants, Inc., P.C.
MGP	Manufactured Gas Plant
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PID	Photoionization Detector
PM-10	Particulate Matter Less than 10 Micrometers in Size
TVOC	Total Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
MEASUREMENTS	
$\mu g/m^3$	micrograms per meter cubed
ppm	parts per million

Executive Summary

This Community Air Monitoring Plan (CAMP) Work Plan has been developed to provide procedures for measuring, documenting, and responding to potential airborne contaminants during intrusive activities below the clean soil cover associated with the Woodworth Avenue – Former MGP Site. The procedures in this CAMP focus on air monitoring techniques and contingency measures designed to mitigate potential airborne contaminants. This CAMP Work Plan is based on the CAMP guidelines established by the New York State Department of Health (NYSDOH) in the New York State Department of Environmental Conservation (NYSDEC) *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC, 2010).

The CAMP provides Air Monitoring Procedures, Alert Levels, Response Levels, Action Levels, and Contingency Measures if Action Levels are approached. Alert Levels are internally established concentration levels for volatile organic compounds only and are not established by the NYSDOH or NYSDEC. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a screening tool to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants during remedial activities. A Response Level is a contaminant concentration level that triggers a temporary work stoppage, continued monitoring, and potential contingent measures. An Action Level is a contaminant concentration that triggers work stoppage and implementation of contingent measures to mitigate potential airborne contaminants prior to resuming work activities. Response Levels and Action Levels are NYSDOH threshold levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of DER-10 (Attachment 1). Exceedances of either Response Levels or Actions Levels will be reported to NYSDEC and NYSDOH.

During times of ground intrusive perimeter air monitoring will be conducted using a combination of fixed-station, moveable tripod-mounted, and "walk-around" air monitoring equipment (as appropriate). Monitoring will be performed for total volatile organic compounds and dust along the Site perimeter 24 hours a day when fixed stations are used or during working hours if the movable tripod-mounted units are used. The Contingency Plan defines Alert Levels, Response Levels, Action Levels, and specific contingency measures to be implemented. The response actions, potentially including work stoppage and work area controls by various methods, are intended to prevent or significantly reduce the migration of airborne contaminants from the Site.

Operable Unit 1 (OU-1) of the Woodworth Avenue former MGP site occupies 4.3 acres of land bounded by Woodworth Avenue to the east, Alexander Street to the west, Ashburton

Avenue to the south, and Babcock Place to the north located in Yonkers, Westchester County, New York. OU-1 is composed of three blocks and seven lots. Metro-North Commuter Railroad runs north-south, bisecting the Site into its western and eastern portions. The western portion of OU-1 is currently used by Greyston Bakery and as a bus turnaround. Metro-North commuter railroad tracks and substation bisect the central portion of the Site. Properties to the south of OU-1 and west along the Hudson River were recently developed into residential apartment buildings. The eastern portion of OU-1, at the time of this document, is being used as a parking lot.

The Woodworth Ave Works former MGP Site is located within an industrial, commercial, storage and light manufacturing area that includes residences to the northeast and east. There has been a significant amount of property development in the vicinity of the Site Hence, there are potential sensitive receptors located around OU-1 since it is bounded by Babcock Place to the north, Ashburton Avenue to the south, Woodworth Avenue to the east, and Alexander Street to the west by 104 Ashburton Avenue LLC, and 1 Park Studios North LLC. No work is expected to be performed within 20-feet of occupied structures.

GEI Consultants, Inc., P.C. (GEI) will implement the CAMP and will report any exceedance of Response Levels and Action Levels to the Contractor, Consolidated Edison Company of New York, Inc. (Con Edison), NYSDOH, and NYSDEC. As specified in the DER-10, all 15-minute readings will be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. The contractor conducting intrusive activities below the clean soil cover will be responsible for enacting contingency measures to respond to Alert Levels, if necessary, and to the exceedances of Alert and Action Levels as they may occur. GEI will provide data summary reports to the Contractor, Con Edison, and NYSDEC each week during ground intrusive activity.

1. Introduction

The New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP), as presented in New York State Department of Environmental Conservation's (NYSDEC) document *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10), recommends that real-time monitoring for total volatile organic compounds (TVOC) and particulates (i.e., dust) be conducted at the downwind perimeter of each designated work area during ground intrusive activities at contaminated sites. As such, this work plan describes the proposed air monitoring means and methods that will be implemented during intrusive activities at Woodworth Avenue– Former MGP Site. A site location map is shown in Fig. 1.

The purpose of the CAMP is to provide early detection in the field of potential short-term emissions and will be conducted in accordance with the generic NYSDOH CAMP.

The objectives of the CAMP are as follows:

- Provide an early warning system to alert the Contractor, Consolidated Edison Company of New York, Inc. (Con Edison), and NYSDEC that concentrations of TVOC or dust in ambient air are approaching Action Levels due to Site activities.

- Provide potential contingency measures to be enacted by the contractor conducting intrusive activities and related contractors that are designed to reduce the off-site migration of contaminants if established Action Levels are approached or exceeded.

- Determine whether construction controls are effective in reducing ambient air concentrations to below Action Levels and make appropriate and necessary adjustments.

- Develop a permanent record that includes a database of perimeter air monitoring results, equipment maintenance, calibration records, and other pertinent information.

1.1 Roles and Responsibilities

GEI Consultants, Inc., P.C. (GEI) will implement the monitoring and reporting components of this CAMP under contract with Con Edison. The contractor performing intrusive activities is responsible for the selection and implementation of appropriate contingency measures that will mitigate the off-site migration of contaminants in response to Action Levels being approached or exceeded. The remainder of this section specifies the roles and responsibilities of each entity relative to the CAMP. A communication flowchart is shown in Fig. 2 with each entity and lines of communication for the CAMP.

1.1.1 GEI Consultants, Inc., P.C.

The scope of GEI's activities will be limited to CAMP monitoring and reporting used for the CAMP. GEI is responsible for the Health and Safety of their employees. GEI's CAMP roles and responsibilities are as follows:

- GEI will monitor and record TVOCs and dust at various locations around the Site as described in the following sections of this CAMP.

- On a daily basis, GEI will communicate to the following entities whether TVOC or dust exceeded Response Levels or Action Levels specified in Section 2.1, and suggest corrective actions required to address the situation. GEI will convey the CAMP results to the entities listed below and inform them if the Alert or Response Levels have been exceeded. GEI will direct contractors at the Site to take action if warranted.

    - **Contractor – TBD**

    - **New York State Department of Environmental Conservation**
      Justin Starr, P.G.
      New York State Department of Environmental Conservation
      Division of Environmental Remediation
      Remedial Bureau C
      625 Broadway
      Albany, New York 12233-7017
      (518) 402-9662

    - **New York State Department of Health**
      Angela Martin

Bureau of Environmental Exposure Investigation
New York State Department of Health
Corning Tower, Empire State Plaza
Albany, New York 12237
(518) 473- 4671

- **Con Edison**
  Melissa Abt Project Manager
  Consolidated Edison Company of New York, Inc.
  31-01 20th Avenue-Building 138
  Astoria, NY 11105
  (718) 204-4331

- GEI will provide, maintain, and operate the equipment used to implement the CAMP.
  - GEI will provide data summary reports to the Contractor, Con Edison, and NYSDEC each week during intrusive activity. The reports will identify Response Level and Action Level exceedances and will include data summary reports for all TVOC and dust data collected.

1.1.2 Contractor

The Contractor is the lead contractor responsible for site activities pertaining to the intrusive activities. The Contractor will be responsible for taking contingent actions in conjunction with Con Edison in response to Response Level and Action Level exceedances. The Contractor will be responsible for taking contingent actions for Alert Levels, if required by GEI and/or Con Edison. The Contractor is responsible for the Health and Safety of their employees.

1.1.3 Con Edison

Con Edison has the responsibility to provide mitigation services related to the release of MGP-related vapors in excess of CAMP Response Level and Action Levels. Con Edison is also ultimately responsible for the remediation of the Site under an approved work plan with NYSDEC. Con Edison will be responsible for directing the Contractor to take contingent actions in conjunction with Con Edison in response to Alert Level (TVOC only), Response Level, and/or Action Level exceedances.

1.1.4 New York State Department of Environmental Conservation

NYSDEC is responsible for the environmental regulatory enforcement for all activities conducted at the site including compliance with this CAMP, storm water runoff mitigation (erosion and sediment control), and all environmental and remediation regulations, policies, and guidance applicable to the Site. NYSDEC may provide on-site oversight personnel for the work being conducted.

2. Sampling and Analytical Procedures

This section of the CAMP presents a detailed description of the air monitoring, air sampling, and analytical procedures, including data management that will be used during ground intrusive site activities. The intent of the real-time monitoring program is to provide early detection in the field of short-term emissions and off-site migration of site-related TVOC and dust.

Real-time monitoring methods will be utilized to measure ambient air concentrations during the project. Monitoring for TVOC and respirable particulate matter (particulate matter less than 10 micrometers in size [PM-10]) will occur at a minimum of two locations and wind direction will be monitored in real-time if an automated monitoring system is utilized. Supplemental monitoring for TVOC and PM-10 will occur along the perimeter of the project site on an as-needed basis. In the event of a possible exceedance of a Response Level or Action Level for TVOC or PM-10, GEI will compare upwind (background) concentrations to downwind concentrations within 60 minutes of the possible exceedance to determine if site activity is causing the Response Level or Action Level exceedance. The air monitoring procedures and equipment are detailed below.

2.1 Alert Level, Response Level, and Action Levels

Alert Levels are not established by the NYSDOH or NYSDEC. An Alert Level is an internally established concentration levels for TVOC only. An Alert Level is set below the levels established by the NYSDOH so that action can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a preemptive screening tool for TVOC to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants during remedial ground intrusive activities.

Response Levels are NYSDOH thresholds levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of DER-10. A Response Level is a contaminant concentration that triggers a temporary work stoppage, continued monitoring, reporting, and/or potential contingent measures. A Response Level serves as a preemptive tool for PM-10 to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants during remedial ground intrusive activities.

Action Levels are NYSDOH threshold levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of DER-10. An Action Level is a contaminant concentration that triggers work stoppage, continued monitoring, reporting, and

implementation of contingent measures to mitigate potential airborne contaminants prior to resuming ground intrusive activities.

For example, if high concentrations of dust are detected on the Site, contingent measures such as spraying water on dry soils may be required to reduce the concentrations and keep them below the Response Level.

The following target parameters and corresponding Alert Levels, Response Levels, and Action Levels were developed in accordance with the NYSDOH Generic CAMP.

Target Parameter	**Alert Level**
TVOC (15-minute average concentration)	3.7 ppm greater than background*
Target Parameter	**Response Level**
Respirable Particulate Matter (PM-10)	100 $\mu g/m^3$ greater than background*
Target Parameters	**Action Level (**)**
TVOC (15-minute average concentration)	5.0 ppm greater than background*
TVOC (1-minute average concentration)	25 ppm
Respirable Particulate Matter (PM-10)	150 $\mu g/m^3$ greater than background*

ppm - parts per million
$\mu g/m^3$ - micrograms per meter cubed
TVOC – total Volatile Organic Compounds
* Background is defined as the current upwind fifteen-minute average concentration.
** Action Level Exceedance Requires Work Stoppage and Mitigation of the condition causing the Exceedance

2.2 Air Monitoring Procedures

During times of intrusive activities, perimeter air monitoring will be conducted using a combination of fixed-station, moveable tripod-mounted, and/or hand-held air monitoring equipment. Monitoring will be performed for TVOC and PM-10 along the Site perimeter 24 hours a day when fixed station equipment is used or during working hours if movable tripod-mounted or hand-held air monitoring equipment is used.

Monitoring for TVOC and PM-10 will occur at a minimum of two locations using real-time monitoring equipment. Readings will be checked manually on a predetermined periodic basis if tripod-mounted equipment is used. Readings will be recorded once per minute and transmitted to a centralized data logger system if fixed-station equipment is used. Supplemental hand-held perimeter monitoring for TVOC and PM-10 will occur along the perimeter of the project site on an as-needed basis. Each approach is detailed below.

It is anticipated that tripod-mounted equipment will be used for minimally intrusive work such as installation of soil borings or monitoring wells. It is anticipated that fixed station equipment will be used for the remedial excavation work at the Site. Supplemental hand-held equipment will be used on an as-needed basis. This may include monitoring directed by Con Edison or NYSDEC, or to supplement fixed monitoring station data in response to visible dust.

2.2.1 Fixed-Station Monitoring Procedures

Real-time fixed-station monitoring equipment will be positioned at a minimum of two locations upwind and downwind of the designated work area. The real-time fixed air monitoring stations will be positioned between the work zone and the largest number of potential off-site receptors. Therefore, the placement of the fixed air monitoring stations is based on the need to document all potential off-site migration on the perimeter, but also recognizes the potential off-site receptors and the location of the proposed construction activities. Fig. 3 displays a typical arrangement of fixed air monitoring stations around the site. Real-time monitors will continuously gather data 24 hours a day 7 days a week.

The air monitoring stations will be supplemented with a meteorological station and a system of transmitting the real-time data to a central data storage location accessible by the project team in the project trailer or similar work area.

Each real-time fixed-station air monitoring station contains the following:

- Station enclosure.
- A photoionization detector (PID).
- A particulate aerosol monitor equipped with a PM-10 impactor.
- A data telemetry device.

Air monitoring equipment will be housed in a protective weather-tight enclosure. Each monitoring station will continuously measure and record TVOC and PM-10 at a rate of one sample per minute and record 15-minute averages. Fig. 4A shows an example of a fixed air monitoring station.

In addition to the air monitoring stations, a meteorological monitoring station will be established on site to continuously monitor and record temperature, relative humidity, wind speed, and wind direction. Fifteen-minute averages for each meteorological

parameter will be transmitted to the central data storage location to determine upwind and downwind stations for assessing Alert, Response, and Action Levels.

All TVOC, PM-10, and meteorological data will be stored in data loggers located within each monitoring/meteorological station. Stored analytical data along with system performance data from each station will be sent in real-time, via telemetry, to the Site central computer system for monitoring and analysis. In the event of severe weather or power loss at the site, data recording and/or recovery may be affected.

2.2.2 Tripod Mounted Monitoring Procedures

Tripod-mounted monitoring equipment will be positioned along the Site perimeter to monitor the air based on a particular day's ground intrusive activities. At a minimum, one tripod-mounted station will be positioned upwind and one tripod-mounted station will be positioned downwind of the designated work area. Real-time monitors will continuously gather data during periods of ground intrusive activity during working hours. The equipment will be manually read on a predetermined periodic basis during the work activities.

The readings will be collected at a minimum of 15-minute intervals during periods of intrusive activities. Wind direction will be determined by using a wind sock or flagging placed on a pole at the Site.

Each tripod-mounted air monitoring station would include the following:

- Station enclosure and Tripod.
- A PID.
- A particulate aerosol monitor equipped with a PM-10 impactor.

Air monitoring equipment will be housed in a protective weather-tight enclosure. Each monitoring station will continuously measure and record TVOC and PM-10 at a rate of one sample per minute and record 15-minute averages. Fig. 4B shows an example of a typical tripod-mounted air monitoring station.

All TVOC and PM-10 will be stored in data loggers located within each monitoring station. Data from each piece of equipment will be downloaded daily and stored on a central storage location. The location of each station, the work zone, and the wind direction will be recorded daily.

2.2.3 Supplemental Hand-held Monitoring

Supplemental hand-held monitoring equipment will be recorded downwind of the designated work area on an as-needed basis. Specific site conditions that may trigger supplemental hand-held monitoring include:

- Visible dust.
- Detection of TVOC and/or PM-10 at an air monitoring station at concentrations exceeding an Alert Level, Response Level, and Action Levels.
- Direction by the Con Edison, or NYSDEC.

Fifteen-minute average TVOC and PM-10 readings will be recorded at a downwind location between the work area and the nearest receptors.

When a triggering condition is observed during ground intrusive activity, the supplemental downwind perimeter monitoring will occur until the conditions that triggered the monitoring have subsided. TVOC concentrations will be monitored and recorded using a PID. PM-10 will be measured and recorded using a particulate aerosol monitor equipped with a PM-10 impactor.

At each monitoring point, the 15-minute average value of TVOC and PM-10, sample time, and sample location will be collected and recorded. Additional temporary monitoring points may be established due to changing site or meteorological conditions.

2.2.4 Equipment Calibration

Equipment calibration will be performed according to manufacturer's instructions. Each PID will be calibrated once daily using an isobutylene gas mixture. Particulate monitors will be purged and zeroed daily. Other hand-held portable equipment will be calibrated before each use, or a minimum of once per week when not in use.

2.3 Pre-Construction Baseline Sampling

Pre-construction monitoring will be completed to establish baseline ambient air concentrations prior to the start of excavation activities. Baseline conditions will be developed for TVOC and PM-10 in ambient air using real-time fixed station sampling methods. Monitoring methods will follow those described in subsection 2.2.1. TVOC and PM-10 data will be recorded 24 hours per day for a minimum of three days. In addition, air samples will be collected for time-weighted average VOC analysis.

2.4 Data Management Procedures

This section of the Plan discusses the data management procedures that will be used during the remedy. Data may be generated from a variety of sources, including real-time fixed station monitoring, supplemental walk-around monitoring, tripod-mounted monitoring stations, and meteorological monitoring.

These data must be reduced, evaluated, verified, and presented to related parties in a timely manner to facilitate decision-making. The data management process for each source of data is discussed below.

Monitoring data generated at each fixed-station are sent to the central computer system via radio telemetry or will be manually downloaded daily. The monitoring data will also be downloaded to the project database for data evaluation. The following daily charts, tables, or figures will be prepared:

- Instantaneous and averaged TVOC concentrations compared to the TVOC Action Level.
- Instantaneous and averaged PM-10 concentrations compared to the PM-10 Action Level.
- Supplemental Hand-Held PM-10 concentrations compared to the Action Level (if any).
- Supplemental Hand-Held TVOC concentrations compared to the TVOC Action Level (if any).
- Air monitoring station locations.

The following weekly charts, tables, or figures will be prepared:

- Maximum 15-minute average concentrations of TVOC and PM-10.
- Upwind and downwind comparison of Response Level and Action Levels reached during the week if the daily maximum 15-minute average concentrations of TVOC and PM-10 exceeded a Response Level or Action Levels.
- Summary of site activities.

- Air monitoring station locations.

GEI will review all real-time data in a timely manner following collection and prepare a final summary report for Con Edison.

3. Response Plan

The purpose of this section is to identify the procedures to be followed in response to elevated levels of target compounds measured during intrusive activities. Response actions will be enacted by the Contractor and Con Edison. GEI will report any occurrences where a Response Level or Action Level is exceeded, which would require response measures to be enacted. The NYSDEC will be notified of any occurrence where a Response Level and/or Action Level (NYSDOH threshold) is exceeded. If there is a verified exceedance, GEI will inform Con Edison and NYSDEC within 60 minutes of the exceedance via e-mail at a minimum. In general, a tiered approach to site conditions with corresponding response actions will be implemented during the air monitoring program. The four tiers of site conditions are defined as follows.

- **Site Condition 1.** Normal or ambient air-conditions where TVOC and PM-10 are less than the Alert and Response Levels.
- **Preliminary Site Condition 2.** Concentration of TVOC only is equal to or greater than the Alert Level, but less than the Action Level.
- **Site Condition 2.** Concentration of PM-10 is equal to or greater than Response Level, but less than the Action Level.
- **Site Condition 3.** Concentration of TVOC or PM-10 is equal to or greater than the Action Level.

The response plan will rely on real-time data generated from the fixed-station equipment and tripod-mounted equipment, and meteorological equipment. These data sources will be evaluated together in order to make appropriate decisions concerning site conditions and potential control measures.

An explanation of the notification system, specific conditions, and response actions for TVOC and PM-10 is presented below.

TVOC and PM-10 concentrations in air will be measured and recorded by station monitors. PM-10 may be temporarily suspended during periods of rain. Fig. 5 presents the TVOC decision diagram that will be used to determine the appropriate site condition based on contaminant concentrations. Fig. 6 presents the PM-10 decision diagram.

Specific TVOC target concentrations for Site Condition 1, Preliminary Site Condition 2, Site Condition 2, and Site Condition 3 are summarized in Table 1.

3.1 Site Condition 1

Site Condition 1 represents normal site conditions and will be in effect when the TVOC concentration is less than the Alert Level of 3.7 ppm and PM-10 is less than the Response Level of 100 $\mu g/m^3$. Under a Site Condition 1, each PID and particulate monitor located at the monitoring stations will collect and analyze TVOC and PM-10 at a frequency of one sample per minute.

3.2 Preliminary Site Condition 2

Preliminary Site Condition 2 will be in effect if the TVOC concentration is greater than or equal to the Alert Level of 3.7 ppm but less than the Action Level of 5.0 ppm.

At this time, the upwind and downwind concentrations will be compared to determine if the Preliminary Site Condition 2 is due to site activities. If downwind TVOC concentrations are greater than upwind concentrations, then it will be assumed that the Preliminary Site Condition 2 is due to site activities.

If the above condition is true, then a Preliminary Site Condition 2 will be verified. Under a verified Preliminary Site Condition 2, GEI will inform Con Edison and the Contractor. The contractor will implement mitigation control measures to abate the emissions and reduce levels back below the Alert Level. Possible Preliminary Site Condition 2 response actions are listed in Table 2. The site will remain in Preliminary Site Condition 2 as long as the TVOC concentration is between 3.7 ppm (Alert Level) and 5.0 ppm (Action Level), based on 15-minute averages.

The site will return to Site Condition 1 if the 15-minute average concentration of TVOC is less than the Alert Level of 3.7 ppm.

3.3 Site Condition 2

Site Condition 2 will be in effect if the average 15-minute PM-10 concentration at a station is greater than 100 $\mu g/m3$ and related to site activities.

The upwind and downwind PM-10 concentrations will be compared to determine if the elevated PM-10 concentrations are due to site activities. If downwind PM-10

concentrations are 100 μg/m3 greater than upwind concentrations (Response Level), then it will be assumed that the Site Condition 2 is due to site activities.

Under Site Condition 2, GEI will inform Con Edison, the Contractor, NYSDEC, and NYSDOH. The Site Condition 2 will remain in effect as long as the average PM-10 concentration is greater than or equal to 100 μg/m3 above upwind conditions (Response Level), and less than or equal to 150 μg/m3 (Action Level). Under a verified Site Condition 2, dust suppression techniques must be implemented by the Contractor. At this point, routine monitoring continues, and 15-minute averages continue to be evaluated. Work may continue with dust suppression techniques if downwind PM-10 levels do not exceed 150 μg/m3 above the upwind level (Action Level) and if no visible dust is migrating off site from the work area.

A contingency meeting/conference call attended by GEI, the Contractor, Con Edison, and NYSDEC will be held within 60 minutes of the verified Site Condition 2 if the condition is not mitigated by dust suppression techniques. Possible response actions for dust control are listed in Table 2.

3.4 Site Condition 3

Site Condition 3 will be in effect if the TVOC concentrations increase to greater than the Action Level of 25.0 ppm or the average 15-minute PM-10 concentration exceeds 150 $\mu g/m^3$ above the current average upwind concentration (Action Level). Site Condition 3 will remain in effect if one of the following conditions is true.

- The TVOC concentration is greater than 25 ppm (Action Level).
- The average 15-minute PM-10 concentration exceeds 150 μg/m3 above the current average upwind concentration (Action Level).

Under Site Condition 3, GEI will inform Con Edison, the Contractor, NYSDEC, and NYSDOH. All construction activities will be halted. The contractor will implement mitigation control measures to abate the emissions and reduce levels back below the Action Levels. Possible Site Condition 3 corrective measures/actions are listed in Table 2. After appropriate corrective measures/actions are taken, work activities may resume if the following conditions are met:

- TVOC concentration at the Site perimeter is no more than 5.0 ppm above background for the 15-minute average; and

- Dust suppression measures and other controls are successful in reducing the downwind PM-10 concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

3.5 Visible Dust

In addition to measured PM-10 levels, the CAMP requires monitoring of visible dust conditions. If visible airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques if downwind PM-10 levels do not exceed the Action Level concentration of 150 $\mu g/m^3$ above the upwind level and if no visible dust is migrating from the work area.

4. Reporting

GEI will prepare and submit weekly reports to the Contractor, Con Edison, and NYSDEC summarizing the CAMP monitoring data. Each report will consist of a letter-style report and charts/tables summarizing the following:

- Maximum 15-minute average concentrations of TVOC, and PM-10.
- Upwind and downwind comparison of Response Levels and Action Level reached during the weekly period.
- Summary of site activities.
- Air monitoring station locations.
- Meteorological conditions.

Following the completion of all work, a Final Engineering Report will be prepared for the site. As part of the report, the CAMP activities will be documented.

5. References

New York State Department of Environmental Conservation. 2010. DER-10/Technical Guidance for Site Investigation and Remediation. Division of Environmental Remediation. May 3, 2010. Appendix 1A. pp. 204-206.

Tables

Table 1. Target Concentrations for Site Conditions
Community Air Monitoring Plan
Woodworth Avenue Former MGP Site
Yonkers, New York

Target Parameter	Internal Requirement[1]	DER-10 generic CAMP requirements[2]	
	Alert Level	Response Level	Action Level
TVOC (15-minute Average Concentration)	3.7 ppm	NA	5.0 ppm
TVOC (1-minute Measured Concentration)	NA	NA	25 ppm
PM-10 (15-minute Average Concentration)	NA	100 µg/m^3	150 µg/m^3

Site Condition	TVOC	PM-10	Notification Required
Site Condition 1	Less than Alert Level (<3.7 ppm)	Less than Response Level (<100 µg/m^3)	NA
Preliminary Site Condition 2	Greater than or equal to Alert Level less than Action Level (≥3.7 ppm and <5 ppm)	NA	Con Edison, Construction manager (if applicable), Contractor
Site Condition 2	NA	Greater than or equal to Response Level and less than Action Level (≥100 µg/m^3 and <150 µg/m^3)	Con Edison, Construction manager (if applicable), Contractor, NYSDEC, and NYSDOH
Site Condition 3	Greater than or equal to Action Level (≥5 ppm or ≥25 ppm)	Greater than or equal to Action Level (≥150 µg/m^3)	

Notes:

[1] Alert Levels are not established by the NYSDOH or NYSDEC and are internally established concentration levels for total volatile organic compounds. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a preemptive tool to trigger contingent measures, if necessary, to assist in minimizing off-site transport of contaminants during remedial activities.

[2] Response Levels and Action Levels are defined in Appendix 1A of the New York State Department of Environmental Conservation *DER-10 / Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010).

µg/m^3 - micrograms per cubic meter

ppm - parts per million by volume

TVOC - total volatile organic compounds

PM-10 - particulate matter (i.e. dust) less than 10 microns in diameter

NA - not applicable

Table 2. Site Conditions and Response Actions
Community Air Monitoring Plan
Woodworth Avenue Former MGP
Yonkers, New York

Site Condition	Control Measure
Site Condition 1	Normal site activities - No control measures required
Site Condition 2	Establish trend of data and determine if evaluation/wait period is warranted Temporarily stop work Temporarily relocate work to an area with potentially lower emission levels Apply water to area of activity or haul roads to minimize dust levels Reschedule work activities Cover all or part of the excavation area Apply VOC emission suppressant foam over open excavation areas Slow the pace of construction activities Change construction process or equipment that minimize air emissions Install a perimeter barrier fence Apply water on haul roads* Wet equipment and excavation faces* Spray water on buckets during excavation and dumping* Haul materials in properly tarped or watertight containers* Restrict vehicle speeds to 10 mph* Cover excavated areas and material after excavation ceases* Reduce the excavation size and/or number of excavations*
Site Condition 3	Halt work Encapsulate construction area and treat air exhaust Perform work during cold weather Cease construction activities Re-evaluate air monitoring work plan

Notes:

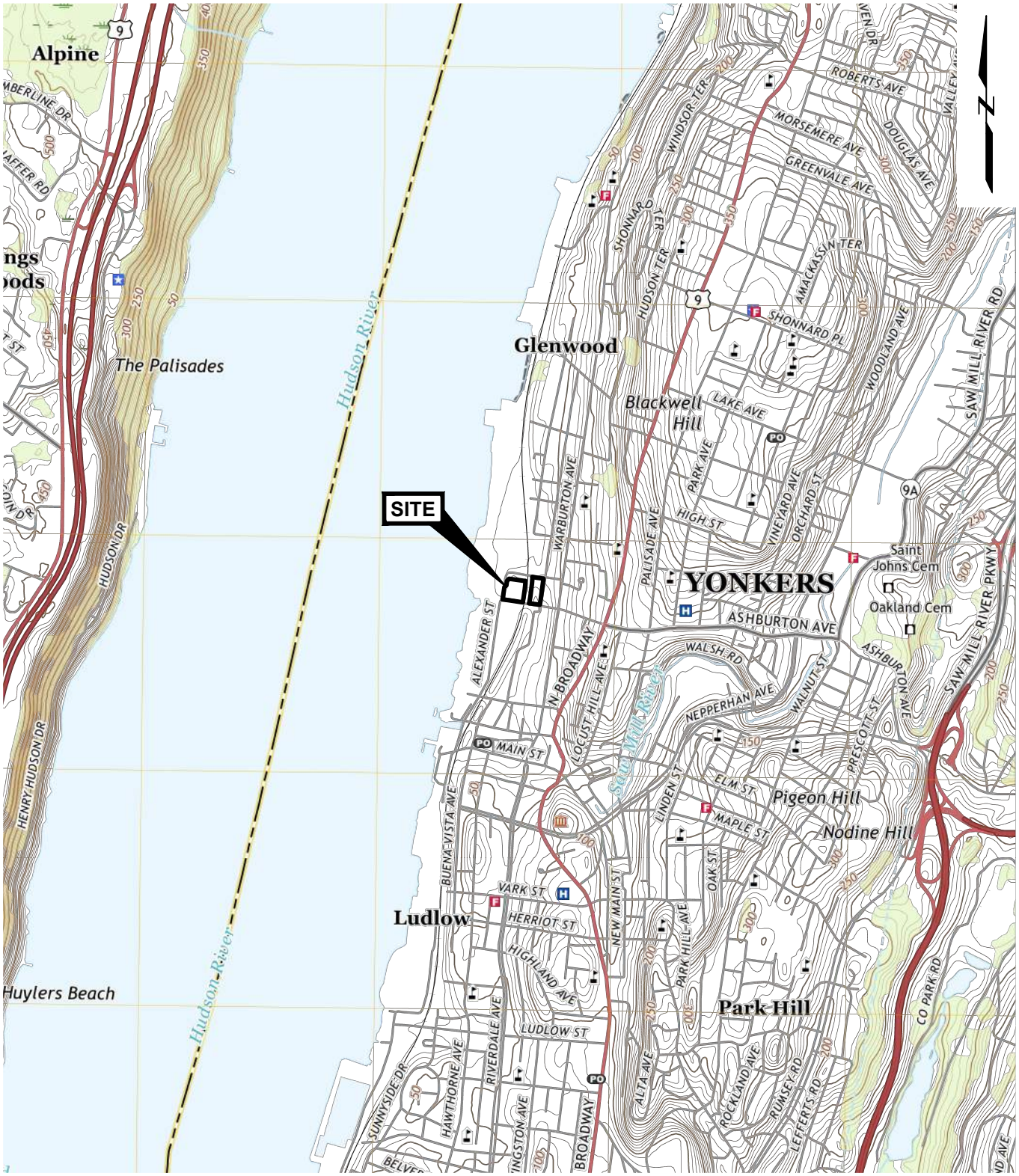
The control measures specified under each site condition can be implemented in any order that is most appropriate under the existing site conditions.

* Control measures suggested in the New York State Department of Environmental Conservation *DER-10 / Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010)

VOC - volatile organic compound

mph - miles per hour

Figures

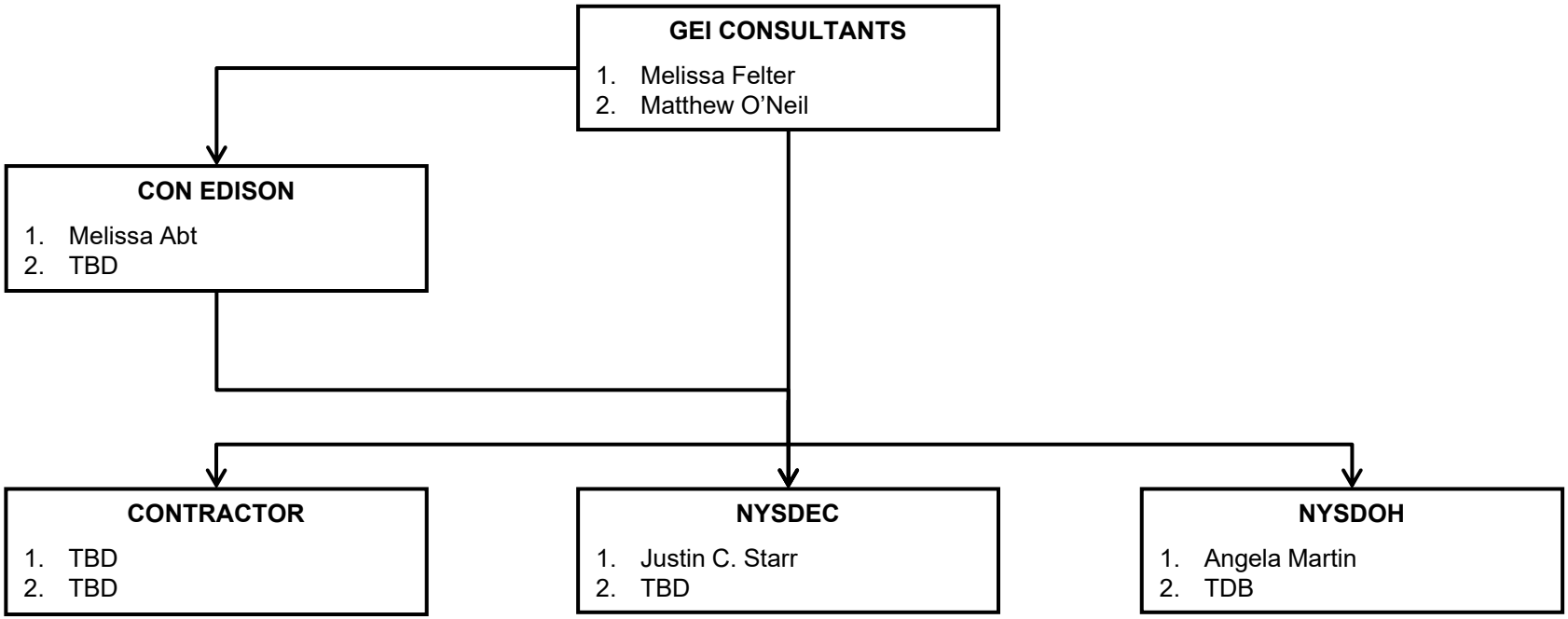


SOURCE:

MAP CREATED WITH YONKERS, NY, NJ QUADRANGLE
USGS TOPOGRAPHIC MAP, 7.5-MINUTE SERIES, 2019.

Community Air Monitoring Plan Woodworth Ave MGP City of Yonkers, New York	GEI Consultants	SITE LOCATION MAP
Consolidated Edison Company of New York New York, New York	Project 2101005	April 2023 Fig. 1

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If the primary contact is unavailable, contact alternatives in the order shown

All applicable parties will be notified within 60 minutes of an exceedance of a Response Level or Action Level at the site perimeter.

NOTE:
TBD = To Be Determined

Community Air Monitoring Plan
Woodworth Avenue Former MGP Site
Westchester County, Yonkers, New York

Consolidated Edison Company Of New York, Inc.
New York, New York

GEI Consultants

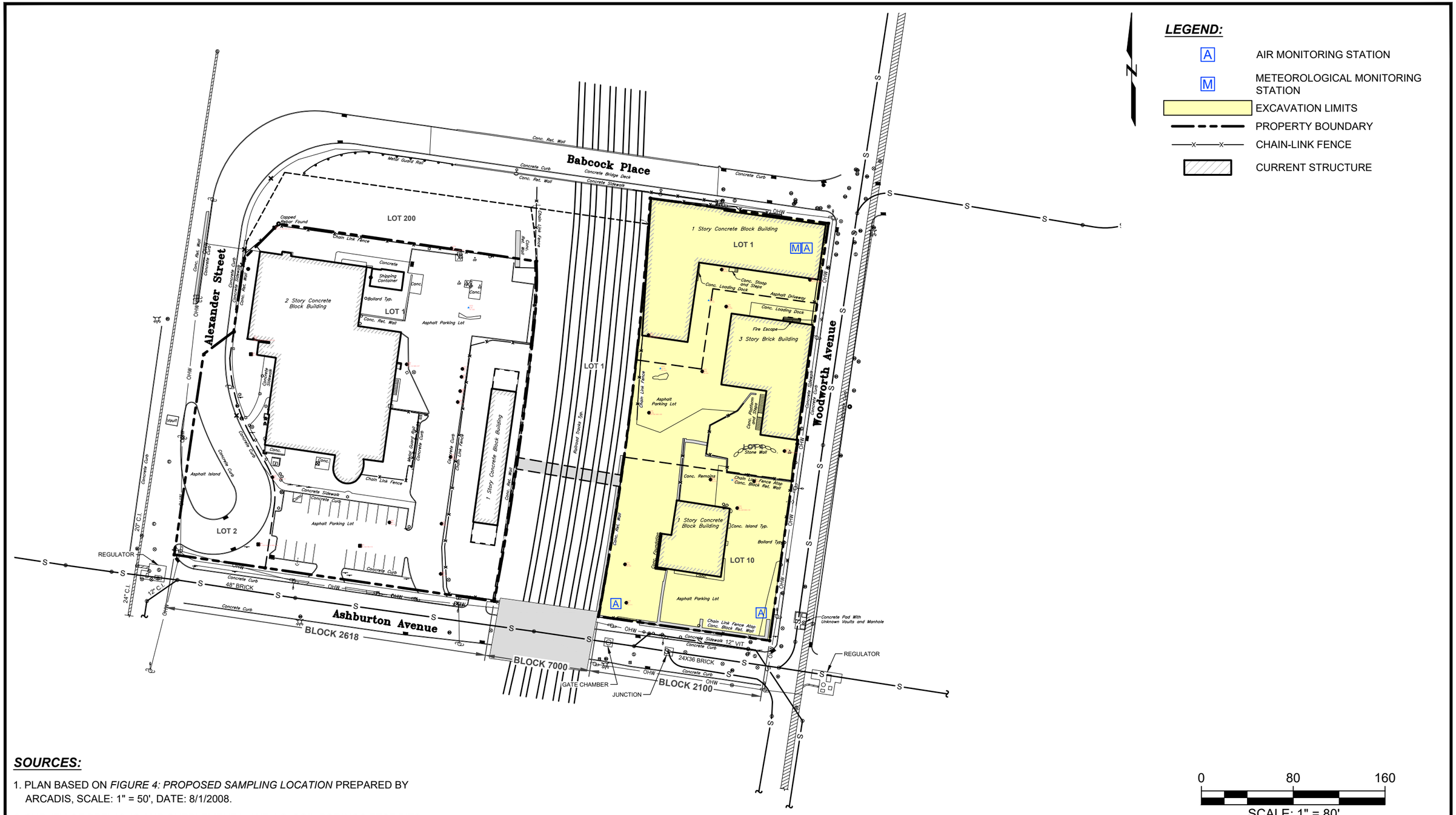
Project 2101005

COMMUNICATION FLOWCHART

April 2023

Fig. 2

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SOURCES:

1. PLAN BASED ON *FIGURE 4: PROPOSED SAMPLING LOCATION* PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: 8/1/2008.
2. SURVEY OF PREVIOUS AND SUPPLEMENTAL WELLS, SOIL BORINGS TEST PITS AND SOIL VAPOR POINTS BASED ON *SHEET 1 OF 1: BOUNDARY SURVEY PREPARED FOR GEI CONSULTANTS,* PREPARED BY TEC LAND SURVEYING, SCALE: 1" = 30', DATE: 8/15/2019.
3. WORLD IMAGERY LAYER FROM ARCGIS.COM, SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

0 80 160

SCALE: 1" = 80'

Community Air Monitoring Plan Woodworth Ave MGP City of Yonkers, New York	GEI Consultants	TYPICAL AIR MONITORING STATION LOCATION PLAN
Consolidated Edison Company of New York New York, New York	Project 2101005	April 2023 Fig. 3

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1. Solar Panel
2. Particulate aerosol monitor sample tubing with in-line condenser
3. Particulate aerosol monitor sample inlet with PM-10 impactor
4. Station enclosure
5. Particulate Aerosol Monitor
6. Photoionization detector (PID)
7. PID sample inlet
8. PID sample inlet tubing
9. Data communications device

NOTE:
Figure depicts an AirLogics™, LLC Light air monitoring station as an example and may not be representative of the actual system or components that will be employed at the site

Community Air Monitoring Plan
Woodworth Avenue Former MGP Site
Westchester County, Yonkers, New York

Consolidated Edison Company Of New York, Inc.
New York, New York

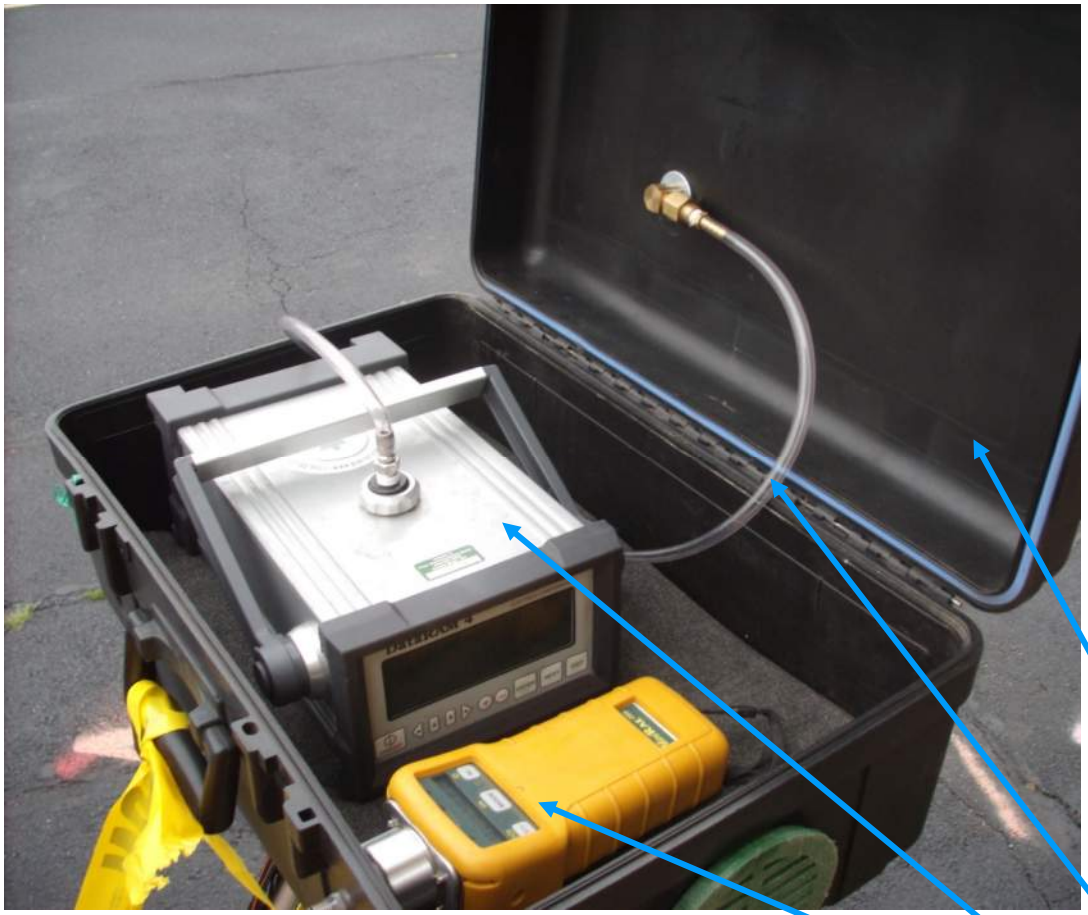
GEI Consultants

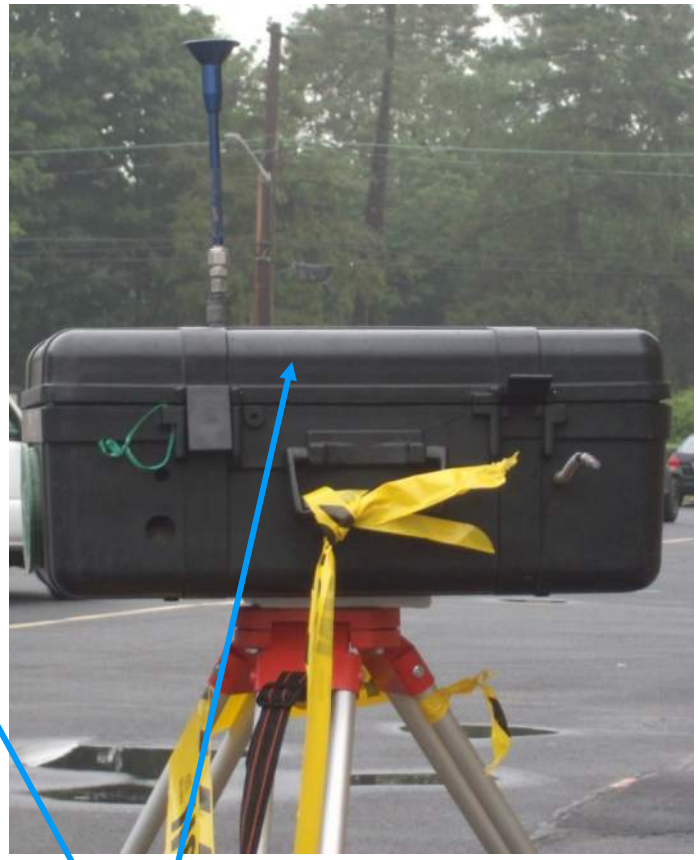
Project 2101005

EXAMPLE FIXED STATION
INTERNAL COMPONENTS

April 2023 Fig. 4A

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(1) (2) (3) (4)

1. Photoionization detector (PID)
2. Particulate aerosol monitor
3. Particulate aerosol monitor sample tubing
4. Station enclosure

NOTE:
Figure depicts a Pine Environmental air monitoring station as an example and may not be representative of the actual system or components that will be employed at the site

Community Air Monitoring Plan
Woodworth Avenue Former MGP Site
Westchester County, Yonkers, New York

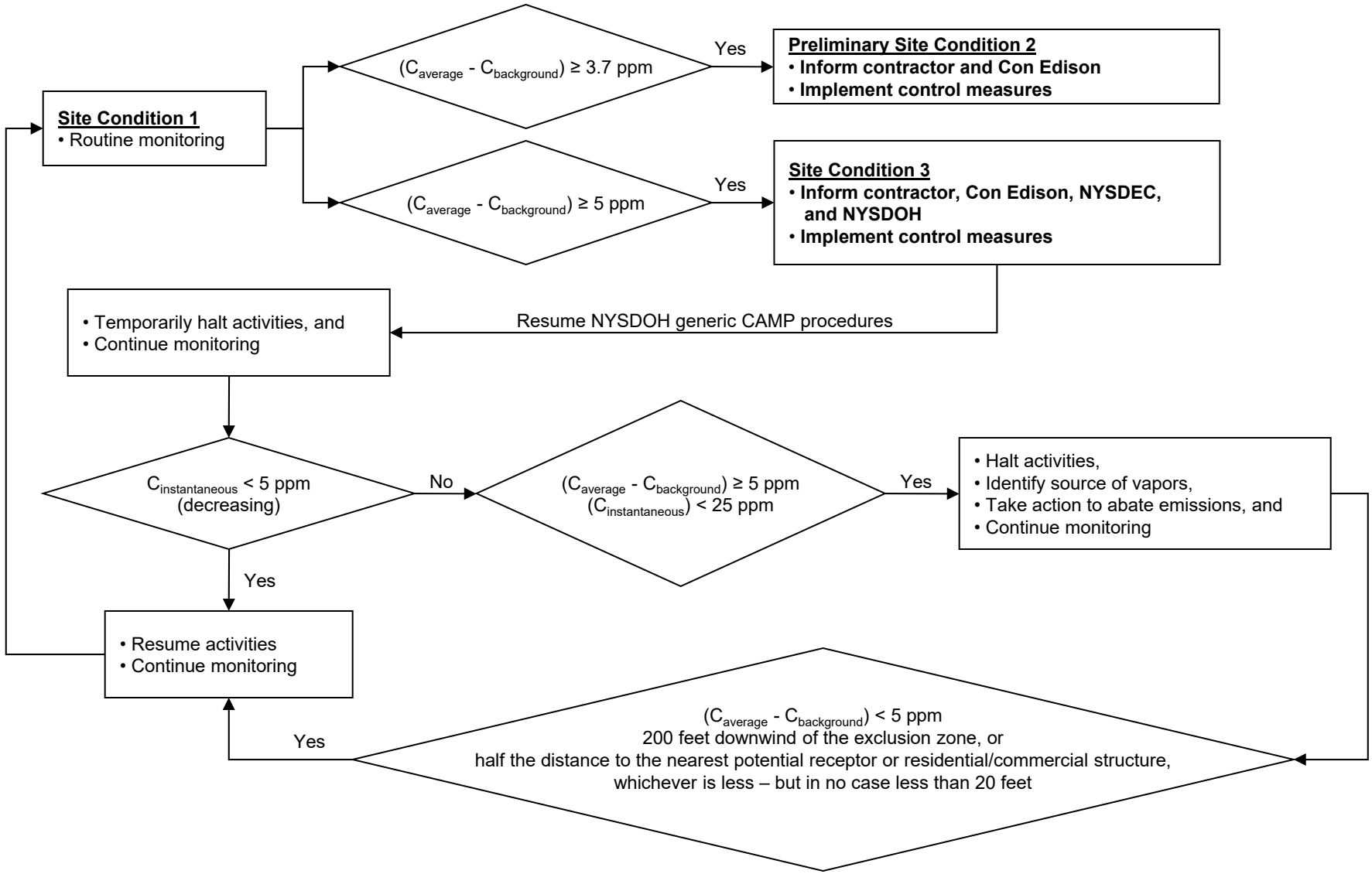
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New York, New York

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Project 2101005

EXAMPLE TRIPOD MOUNTED STATION INTERNAL COMPONENTS

April 2023 Fig. 4B



NOTES:

1. TVOC – Total Volatile Organic Compound
2. ppm – parts per million
3. $C_{average}$ = 15-minute average concentration
4. $C_{background}$ = 15-minute average concentration upwind
5. $C_{instantaneous}$ = 1-minute measured concentration

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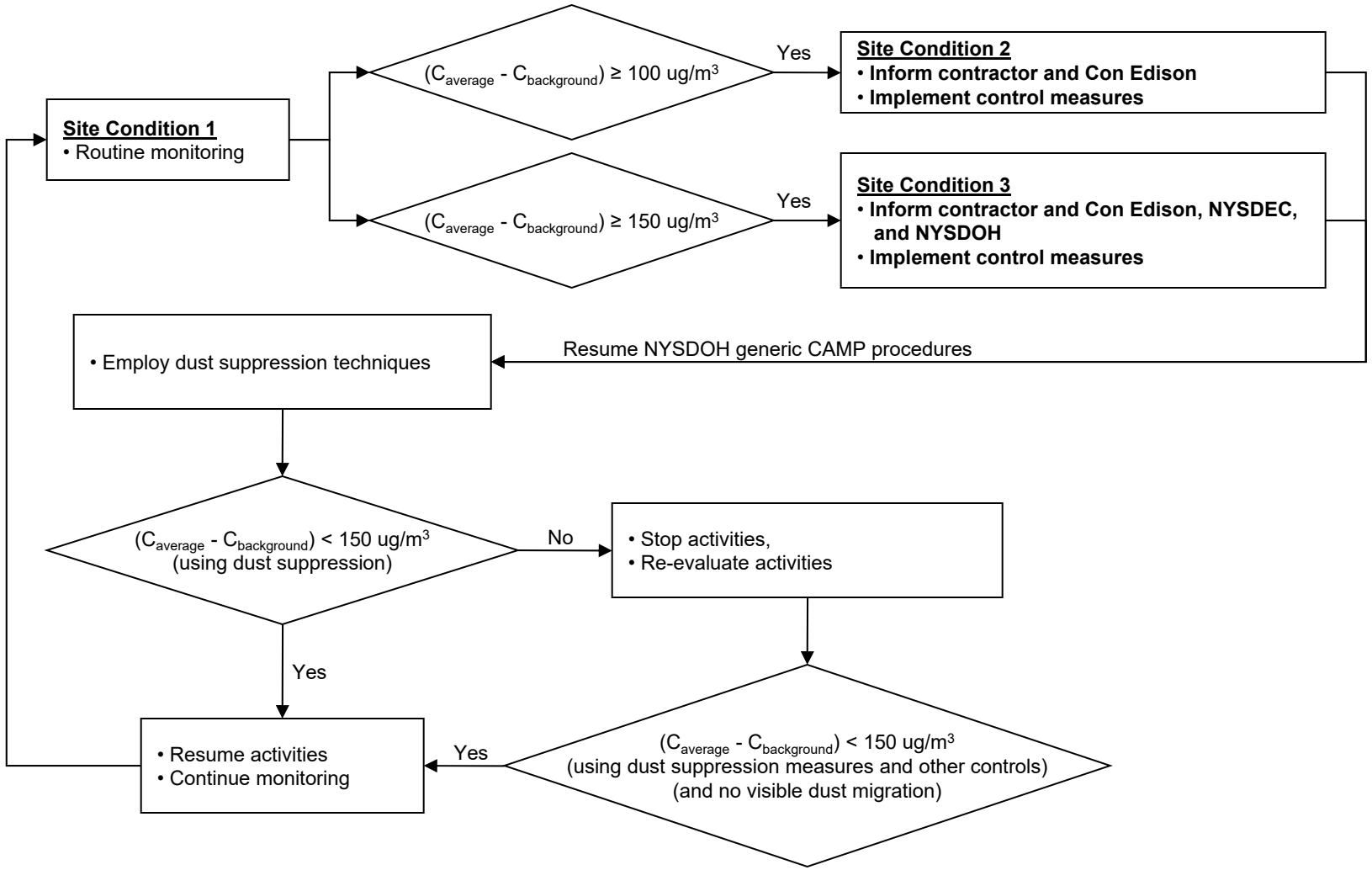
Project 2101005

TVOC
DECISION DIAGRAM

April 2023

Fig. 5

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NOTES:

1. PM-10 – particulate matter
2. µg/m^3 – micrograms per cubic meter
3. $C_{average}$ = 15-minute average concentration
4. $C_{background}$ = 15-minute average concentration upwind

Community Air Monitoring Plan
Woodworth Avenue Former MGP Site
Westchester County, Yonkers, New York

Consolidated Edison Company Of New York, Inc.
New York, New York

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Project 2101005

PARTICULATE MATTER DECISION DIAGRAM

April 2023

Fig. 6

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Appendix A

NYSDOH Generic CAMP from DER-10 Appendix 1A

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

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 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 DEC/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

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, particularly if wind direction changes. 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.

1. 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.

2. 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.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) 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.

1. 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.

2. 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.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

Appendix C

Health and Safety Plan



GEI Consultants

Consulting
Engineers and
Scientists

Health and Safety Plan

Former Woodworth Avenue Works

Yonkers, New York
Site ID: V00564

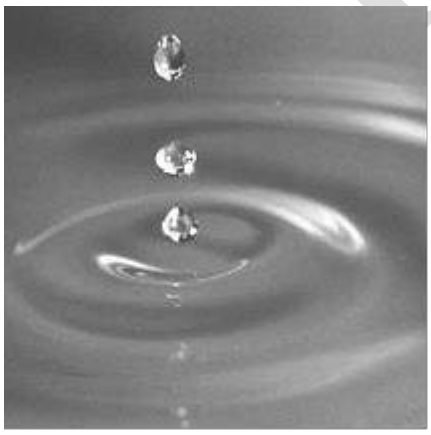
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31-01 20th Avenue
Astoria, NY 11105

Submitted by:
GEI Consultants, Inc.
5586 Post Road, Suite 1
East Greenwich, RI 02818
401.533.5152

February 2019

Project No. 1900674

Final



Melissa Felter, P.G.
Project Manager

Jeena Sheppard
Regional Health and Safety Officer

GEI Consultants

June 2020

Former Woodworth Avenue Works
HASP Addendum

Addendum 1

GEI added additional text to the utility clearance section to reflect the Human Performance Improvement (HPI) Tools.

The following Corporate Environmental, Health and Safety Procedures (CEHSP) document have been updated in the attached HASP to reflect the most current version.

Utility Clearance Process for Intrusive Activities – Corporate EH&S Remediation Program, Revision 3, – May 22, 2020.

GEI added corporate guidelines for performing field work activities throughout the COVID-19 coronavirus outbreak. Additional Con Edison guidelines to vendors for performing work in response to the COVID-19 outbreak have been added to the attached HASP.

GEI added additional text to the project description and hazard analyses to reflect the additional project work scope of surficial sediment sample collection and oversight of sewer video inspections.

Final

2.1 General

Engineer GEI Consultants, Inc., P.C. (GEI)
5586 Post Road, Suite 1
East Greenwich, RI 02818

Project Name Former Woodworth Avenue Works
Woodworth Avenue and Ashburton Avenue
Yonkers, New York

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the Former Woodworth Avenue Works located between Woodworth Avenue and Ashburton Avenue in Yonkers, New York. Reading of the HASP is required of on-site GEI personnel and will be reviewed by GEI subcontractors. Subcontractors for this project will be required to develop their own HASP for protection of their employees, but at a minimum must adhere to applicable requirements set forth in this HASP. GEI will verify that its subcontractor's HASP includes Con Edison's site-specific requirements, as outlined in this HASP. Additionally, federal, state and local representatives, as well as Con Edison employees may be required to sign and adhere to this HASP, depending on the nature of their presence onsite during activities conducted by GEI. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions. Activities performed under this HASP will comply with applicable parts of OSHA Regulations, primarily 29 Code of Federal Regulations (CFR) Parts 1910 and 1926, and Con Edison policies and procedures. A copy of this HASP will be maintained on site for the duration of the work.

Included in Section 1 and Appendix A is a route to the nearest medical facility from the Site with directions and contact information. Safety data sheets (formerly known as Material Safety Data Sheets [MSDS]), specific to chemicals that may be used while working at the Site, are in Appendix B. Appendix C details the signs, symptoms, care and procedures to both heat and cold stress. Appendix D includes the Tailgate Safety Briefing form, the Project Safety Briefing form, the Accident/Incident Report Form and the Near Miss Reporting Form. Appendix E contains the GEI Health and Safety (H&S) Standard Operating Procedures (SOPs) that apply to this project, updated in June 2020. Appendix F contains the Con Edison Corporate Environmental, Health, and Safety Procedures that apply to this project. Appendix G contains the GEI's Hazard Communication (HAZCOM) Program. Appendix H contains Con Edison Coronavirus COVID-19 Guidelines. Appendix I contains the GEI Coronavirus COVID-19 Field Work Guidelines, dated April 2020.

2.2 Project Description

The project will include the installation of soil borings, test pits, subsurface soil sampling, installation and sampling of groundwater monitoring wells, installation of temporary soil vapor sampling probes, monitoring and recovery of dense nonaqueous phase liquids (DNAPL), video inspections of the sewer system, and collection of surficial sediment samples at low tide on the bank of the Hudson River. This RI is intended to determine the nature and extent of MGP-related by-products on the Former Woodworth Avenue Works Site. All investigation activities will be conducted in accordance with this Health and Safety Plan (HASP) and Field Sampling Plan (FSP).

Final

2.4 Con Edison Corporate Environmental, Health and Safety Procedures

GEI and GEI's Subcontractors agree to abide by the conditions of the Con Edison Corporate Environmental, Health, and Safety Procedures (CEHSPs) included in Appendix F of this HASP while conducting work at the Site. Specifically, the applicable CEHSPs included are:

- CEHSP E08.02 – Noise Construction and Utility Activities
- CEHSP S05.03 – Personal Protective Equipment – Protective Clothing
- CEHSP S12.00 – Lockout Tagout Procedures
- CEHSP S17.01 – Electrical Enclosed Spaces
- CEHSP A28.00 – Calling a Time Out
- CEHSP A32.00.01 – Rules We Live By, with 2016 (January 31, 2016) 'Rules' Table*
- Utility Clearance Manual for Intrusive Activities – Corporate EH&S Remediation Program, Revision 3, May 22, 2020
- Work Area Protection Field Manual
- Coronavirus (COVID-19) Guidelines

*Work at this Site will comply with the Central Operations Column of the Rules We Live By table.

4.1.1 Coronavirus (COVID-19)

GEI field employees will follow the COVID-19 Field Guidance in Appendix E.

Distancing
COVID-19 spreads from person-to-person primarily through droplets that are emitted from the initial person to a distance of 6 feet.

- Maintain a distance of at least 6 feet (2 meters) from others. This includes during site meetings and breaks and while performing work tasks. Meetings should be held outside or by phone/video.
- Minimize the number of employees in one location to the extent possible. Follow local restrictions for maximum number of people congregated in one location at a time.
- If tasks need to be performed close to others (within 6 feet) and that cannot be avoided, wear appropriate PPE including a face mask (surgical or cloth), gloves, and eye protection.
- NOTE: Face masks are not a substitute for distancing. Masks are meant to protect others in case you are infected. Contact the Safety Team (safetyteam@geiconsultants.com) to discuss any special circumstances and the PPE warranted.
- Wear nitrile gloves as much as practicable and change them frequently. As practicable, wash your hands or use sanitizer between glove changes. Wash your hands after wearing gloves.
- Minimize and stagger time in office spaces to performing essential duties such as picking up and dropping off equipment and samples. If you need to spend more time in a project

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GEI Consultants

June 2020

Former Woodworth Avenue Works
HASP Addendum

Addendum 2

GEI added additional text describing dense nonaqueous phase liquids (DNAPL) monitoring and recovery at two adjacent properties. The attached figures show the additional locations.

APPROVED

GEI Consultants

August 2022

Former Woodworth Avenue Works
HASP Addendum

Addendum 3

GEI added additional SDSs to Appendix B for additional decontamination fluids to be used at the Site.

GEI Consultants

February 2023

Former Woodworth Avenue Works
HASP Addendum

Addendum 4

GEI revised Section 2.2, Project Description, of the HASP to reflect the additional scope of work not previously covered under the HASP, as described in the proposed Interim Remedial Measure Work Plan

GEI Consultants

March 2023

Former Woodworth Avenue Works
HASP Addendum

Addendum 5

GEI revised Section 2.2, Project Description, of the HASP to reflect the additional scope of work not previously covered under the HASP, as described in the Well Decommissioning Work Plan. Activities include removing the existing well covers using a concrete saw or jack hammer, tremie-grouting the recovery wells, and restoring the ground surface. These activities are included in the existing HASP in Section 4 – Hazard/Risk Analysis, Table 2 - Activity Hazard Analysis under handling/mixing cement and drilling activities (pages 13 and 14).

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D. Forms
E. GEI Health and Safety SOPs
F. Con Edison Corporate Environmental, Health, and Safety Procedures
G. Hazard Communication (HAZCOM) Program

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1. Emergency Contact Information

Table 1. Emergency Information

Important Phone Numbers	
Local Police:	911
Fire Department:	911
Ambulance:	911
State Police or County Sheriff:	911
Hospital and Occupational Clinic Information *(See Attached Maps and Directions in Appendix A)*	
St. John Riverside Hospital: 2 Park Avenue Yonkers, NY 10703 **Sancia Health Care:** 10 Pallisade Avenue Yonkers, NY 10701	(914) 964-7300 (914) 423-4466
Contacts	
Project Manager: Melissa Felter	(860) 368-5328 office (860) 608-9717 cell
Corporate Health and Safety Officer: Steve Hawkins	(860) 368-5348 office (860) 916-4167 cell
Regional Health and Safety Officer: Jeena Sheppard	(856) 291-5663 office (856) 298-7138 cell
GEI People Team:	(781) 721-4117 Boston (916) 631-4596 Sacramento
Medcor Triage	1-800-775-5866
Client Contact: Melissa Reindl	(718) 204-4331 office (646) 860-5143 cell
Other Information	
Contractor Requesting/Performing Utility Clearance: Utility Clearance Ticket Number:	TBD
Nearest Telephone Location (or alternate means of communication)	On-site Cellular

Final

2. Background Information

2.1 General

Engineer GEI Consultants, Inc., P.C. (GEI)
5586 Post Road, Suite 1
East Greenwich, RI 02818

Project Name Former Woodworth Avenue Works
Woodworth Avenue and Ashburton Avenue
Yonkers, New York

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the Former Woodworth Avenue Works located between Woodworth Avenue and Ashburton Avenue in Yonkers, New York. Reading of the HASP is required of on-site GEI personnel and will be reviewed by GEI subcontractors. Subcontractors for this project will be required to develop their own HASP for protection of their employees, but at a minimum must adhere to applicable requirements set forth in this HASP. GEI will verify that its subcontractor's HASP includes Con Edison's site-specific requirements, as outlined in this HASP. Additionally, federal, state and local representatives, as well as Con Edison employees may be required to sign and adhere to this HASP, depending on the nature of their presence onsite during activities conducted by GEI. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions. Activities performed under this HASP will comply with applicable parts of OSHA Regulations, primarily 29 Code of Federal Regulations (CFR) Parts 1910 and 1926, and Con Edison policies and procedures. A copy of this HASP will be maintained on site for the duration of the work.

Included in Section 1 and Appendix A is a route to the nearest medical facility from the Site with directions and contact information. Safety data sheets (formerly known as Material Safety Data Sheets [MSDS]), specific to chemicals that may be used while working at the Site, are in Appendix B. Appendix C details the signs, symptoms, care and procedures to both heat and cold stress. Appendix D includes the Tailgate Safety Briefing form, the Project Safety Briefing form, the Accident/Incident Report Form and the Near Miss Reporting Form. Appendix E contains the GEI Health and Safety (H&S) Standard Operating Procedures (SOPs) that apply to this project. Appendix F contains the Con Edison Corporate Environmental, Health, and Safety Procedures that apply to this project. Appendix G contains the GEI's Hazard Communication (HAZCOM) Program.

Final

2.2 Project Description

The project will include the installation of soil borings, test pits, subsurface soil sampling, installation and sampling of groundwater monitoring wells, and installation of temporary soil vapor sampling probes. The scope of the Site Characterization (SC) will include the advancement of 22 soil borings, installation of five test pits, installation and sampling of 11 groundwater monitoring wells, and installation of four soil vapor ports. This SC is intended to determine the presence and extent of MGP-related by-products on the Former Woodworth Avenue Works Site. The SC activities will be conducted in accordance with this Health and Safety Plan (HASP) and Field Sampling Plan (FSP).

2.3 Site Description

The Former Woodworth Avenue Works is located in Yonkers, New York 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. 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).

2.4 Con Edison Corporate Environmental, Health and Safety Procedures

GEI and GEI's Subcontractors agree to abide by the conditions of the Con Edison Corporate Environmental, Health, and Safety Procedures (CEHSPs) included in Appendix F of this HASP while conducting work at the Site. Specifically, the applicable CEHSPs included are:

- CEHSP E08.02 – Noise Construction and Utility Activities
- CEHSP S05.03 – Personal Protective Equipment – Protective Clothing
- CEHSP S12.00 – Lockout Tagout Procedures
- CEHSP S17.01 – Electrical Enclosed Spaces
- CEHSP A28.00 – Calling a Time Out
- CEHSP A32.00.01 – Rules We Live By, with 2016 (January 31, 2016) 'Rules' Table*

Final

- Utility Clearance Process for Intrusive Activities – Corporate EH&S Remediation Program, Revision 1A, December 31, 2007
- Work Area Protection Field Manual

*Work at this Site will comply with the Central Operations Column of the Rules We Live By table.

Final

3. Statement of Safety and Health Policy

3.1 GEI

GEI is committed to providing a safe and healthy work environment for its employees. To maintain a safe work environment, GEI has established an organizational structure and a Corporate Health and Safety Program to promote the following objectives:

- Reduce the risk of injury, illness, and loss of life to GEI employees.
- Maintain compliance with federal, state, and other applicable safety regulations; and minimize GEI employees' work exposure to potential physical, chemical, biological, and radiological hazards.

Safety policy and procedure on any one project cannot be administered, implemented, monitored, and enforced by any one individual. The total objective of a safe, accident free work environment can only be accomplished by a dedicated, concerted effort by every individual involved with the project from management down to all employees.

Each GEI employee must understand their value to the company; the costs of accidents, both monetary, physical, and emotional; the objective of the safety policy and procedures; the safety rules that apply to the safety policy and procedures; and what their individual role is in administering, implementing, monitoring, and compliance of their safety policy and procedures. This allows for a more personal approach to compliance through planning, training, understanding, and cooperative effort, rather than by strict enforcement. If for any reason an unsafe act persists, strict enforcement will be implemented.

3.2 Con Edison

Con Edison will have final responsibility and authority for all aspects of the project, and is also responsible for approving all changes to this HASP. GEI provides general health and safety oversight as Con Edison's Agent. The Consultant also conducts perimeter air monitoring and work zone monitoring for GEI employees. The Consultant will monitor daily operations and will serve as the Contractor's primary point of contact with Con Edison and regulatory agencies for health-and-safety related matters.

3.3 Contractors

Contractors are responsible for all work detailed in the project work plan and/or Contractor Statement of Work. Contractors are also responsible for the health and safety of Contractor and Subcontractor employees, and conduct work zone monitoring for Contractor and Subcontractor workers. GEI requires its Contractors (e.g. drillers, air monitoring equipment vendors, etc.) to work in a responsible and safe manner, and is responsible for work zone

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monitoring for them. Contractors for this project will be required to develop their own HASP for protection of their employees and at a minimum must adhere to applicable requirements set forth in this HASP.

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4. Hazard/Risk Analysis

The potential hazards associated with site conditions and activity hazards related to GEI on-site activities have been identified in this section.

1. Special Site Conditions or Concerns

- Traffic – The majority of traffic on the project site will be construction traffic and city traffic.
- Drill Rig/Equipment – Drilling contractor will use truck-mounted rotary drill rigs. Specific attention given to rotating equipment, pinch points, and overhead equipment.
- Difficult site access – Site access is moderate to difficult due to small roads and city parking.
- Hazardous winter conditions – Cold stress, slippery surfaces, and icy Hazardous Summer Conditions – heat stress, dehydration and heat stroke are possible dangers.

Safety equipment will include: First aid kit, fire extinguisher, eye wash bottles, adequate supply of drinking water and electrolyte fluids, hand cleaner, insect repellent, sunscreen, and cell phone. Personal Protective equipment is discussed in section 5.

Physical hazards associated with heavy equipment and drilling operations are present. The heavy equipment associated with this project will include drilling and material removal equipment. Some of the hazards associated with this equipment include being struck-by equipment or caught in between equipment potentially resulting in crushing of limbs, slipping, tripping, or falling, and heavy lifting.

The Drilling/Excavation Contractor should verify that electric, gas, water, steam, sewer, and other service lines are shut off, capped, or otherwise controlled, at or outside the building before demolition work is started. In each case, any utility company that is involved should be notified in advance by the Contractor, and its approval or services, if necessary, will be obtained.

Smoking is prohibited at or in the vicinity of hazardous operations or materials. Where smoking is permitted, safe receptacles will be provided for smoking materials. The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

Final

4.1 Personal Safety

Field activities have the potential to take employees into areas which may pose a risk to personal safety. The following websites (sources) have been researched to identify potential crime activity in the area of the project:

- www.crimereports.com: No crimes identified in the past 30 days within a mile of the Site
- www.cityrating.com/crimestatistics.asp: n 2016 the city violent crime rate in Yonkers was higher than the violent crime rate in New York by 23.91% and national average violent crime rate (by 17.4%).
- www.crimemapping.com: No crimes identified in the past 30 days within a mile of the Site.

To protect yourself, take the following precautions:

- If deemed necessary by the PM, use the buddy system (teams of a minimum of two persons present);
- Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave;
- Call in regularly;
- Pay attention to what is going on around you; and
- If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely.

Employees must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If employees encounter hostile individuals or a confrontation develops in the work area, suspend work activities, immediately leave the area of concern, and contact local 911 for assistance. Notify the SSO and Corporate Health and Safety Officer (CHSO) of any incidents once you are out of potential danger.

In the event of an emergency, prompt communications with local emergency responders is essential. At least one charged and otherwise functioning cell phone to facilitate emergency communications will be on-site. Confirmation of cellular phone operation will be confirmed at the start of each working day.

4.2 Activity Hazard Analysis

The potential hazards for this project associated with site conditions and activity hazards associated with GEI on-site activities have been identified in Table 2. General hazards and control measures that are applicable to all site activities are identified in the General Hazards

Final

section. The site-specific tasks, potential hazards, and control measures established to reduce the risk of injury or illness are identified in the Activity Hazard section of Table 2. Health and Safety SOPs for routine hazards and common site conditions are referenced in the table below and included in Appendix E.

Table 2. Activity Hazard Analysis

General Hazards These Hazards Apply to All Site Activities	Control Measure
Chemical / Contaminant Exposure – Skin and eye injury/irritation	• Wear protective coveralls (e.g. Tyvek®) with shoe covers, safety glasses, face shield, Nitrile gloves. • Dispose of gloves after use and wash hands. • Avoid contact with pooled liquids and limit contact with contaminated soils/groundwater.
Cold Stress – Hypothermia, Frostbite	• Take breaks in heated shelters when working in extremely cold temperatures. • Drink warm liquids to reduce the susceptibility to cold stress. • Wear protective clothing (recommended three layers: an outside layer to break the wind, a middle layer to provide insulation, and an inner layer of cotton of synthetic weave to allow ventilation). • Wear a hat and insulated boots. • Keep a change of dry clothing available in case clothes become wet. • Do heavy work during the warmer parts of the day and take breaks from the cold. • If possible shield work areas from drafts of wind and use insulating material on equipment handles when temperatures are below 30°F • Watch for symptoms of cold stress. (see Appendix C in HASP)

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General Hazards These Hazards Apply to All Site Activities	Control Measure
Driving	• Employees must wear their safety belt while in a moving vehicle. • Vehicle accidents will be reported in accordance with GEI's accident reporting procedures. • Vehicles will be properly maintained and safely operated (refer to GEI's Fleet Maintenance Program). • Employees will follow safe driving behaviors, which include limiting distractions such as manipulating radios or other equipment that may cause a distraction. Employees should not exceed the posted speed limit and should maintain a safe distance between other vehicles. • Use defensive driving techniques. • Driving distance and time after a 12-hour shift should not exceed 30 miles or 30 minutes (whichever is greater). • See SOP HS-004
Dusty Conditions – Eye and respiratory irritation	• Use water mist to suppress dust • Avoid travel at extreme times • Wear protective gear – dust masks, safety glasses
Heat stress – Fainting, Fatigue, Heat Stroke	• Increase water intake while working. • Increase number of rest breaks and/or rotate workers in shorter work shifts. Rest in cool, dry areas. • Watch for signs and symptoms of heat exhaustion and fatigue. • Plan work for early morning or evening during hot months. • Use ice vests when necessary. • In the event of heat stroke, bring the victim to a cool environment and initiate first aid procedures. • See Appendix C of the HASP
Inclement Weather	• Listen to local forecasts for warnings about specific weather hazards such as tornados, thunder storms, and flash floods. • If the storms produce thunder and/or lightning, leave the work area immediately and move to a safe area. • Discuss an action plan prior to the severe weather. • Wear appropriate PPE for the type of weather that could be encountered. • Stop work until conditions are suitable. Take cover in vehicles or shelter as appropriate. • See SOP HS-010

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General Hazards These Hazards Apply to All Site Activities	Control Measure
Insects – Bites, Stings, Allergic Reactions	• Apply insect repellent prior to performing field work and as often as needed throughout the work shift • Wear proper protective clothing (work boots, socks and light colored clothing) • Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many insects are most active (between dawn and dusk). • When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible • Field personnel who may have insect allergies should have bee sting allergy medication on site and should provide this information to the SSO and the CHSO prior to commencing work. • Field personnel should perform a self-check at the end of the day for ticks. • See SOP HS-001
Physical Injury – Slips, Trips and Falls	• Wear PPE that properly fits, is in good condition and appropriate for the activities and hazards. • Maintain good visibility of the work area. • Avoid walking on uneven, steeply sloped or debris ridden ground surfaces. • Plan tasks prior to preforming them including an activity hazard analysis. • Keep trafficked areas free from slip/trip/fall hazards. • Maintain weed growth in sampling areas, especially on slopes. • Wear shoes with traction. • Avoid traversing steep areas in slippery conditions. • Do not carry heavy objects to sampling areas, on steeply sloped areas, or where steep areas must be traversed to arrive at sample points.

Final

General Hazards These Hazards Apply to All Site Activities	Control Measure
Poisonous Plants - Poison Ivy, Poison Oak, and Poison Sumac	• Avoid areas infested with poisonous plants. • Use a barrier cream to provide some protection. • Wash exposed clothing separately in hot water with detergent. • After use, clean tools, and soles of boots with rubbing alcohol or soap and lots of water. • Immediately wash with soap and water any areas that come into contact with poisonous plants. • If exposed to a poisonous plant, wash with soap and water or a product such as TechnuTM. First aid kits are available in the company vehicles. • See SOP HS-001
Repetitive Motion Injury - Standing, Squatting, and Bending Over	• Take regular breaks and do not work in unusual positions for long periods of time. • Walk and stretch between tasks. • See SOP HS-025
Unsecured or High Crime Areas	• Be aware of your surroundings. • Use the buddy system. Do not remain on site alone. Accompany or be accompanied by others to vehicles. • Request police detail when appropriate. • Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave. • Call in regularly. • If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely.
Utilities – Shock, Electrocution, Fire, Explosion	• A thorough underground utility survey must be conducted prior to intrusive activities. Coordination with utility locating services, property owner(s) or utility companies must be conducted. • Utilities are to be considered live or active until documented otherwise. • For overhead utilities within 50 feet, determine with the utility company the appropriate distance. Minimum distance for clearance is based on voltage of the line. • If exposing a utility, proper support and protection must be provided so that the utility will not be damaged. • If a gas line is contacted, the contractor must notify police, fire, and emergency personnel, and evacuate employees according to the site evacuation procedures. No attempt should be made to tamper with or correct the damaged utility. • See SOP HS-014

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General Hazards These Hazards Apply to All Site Activities	Control Measure
Vehicular Traffic – Struck by injury, crushing	• Increase visibility of the work area to others by using cones, flags, barricades, proper lighting and caution tape to define work area. • Use a "spotter" to locate oncoming vehicles. • Use vehicle to block work area. • Engage police detail for all work conducted in appropriate areas. • Wear high-visibility, reflective vest at all times. • Maintain minimum DOT defined distances to other traffic lanes. • See SOP HS-016.
Wildlife – Bites, Allergic Reaction, Disease	• Wear boots, avoid as much as possible and approach with caution as necessary. • Avoid contact with wild animals. Put on hip or chest waders (if available) prior to walking through vegetation. • See SOP HS-001

Activity	Potential Hazard	Control Measures
Carrying Equipment	Heavy lifting, strains/sprains, slips/trips/falls, pinch points	• Use proper lifting techniques as defined in the heavy lifting activity analysis below • Wear the proper type of glove to protect hands against sharp edges and skin/soft tissue injuries • Wear appropriate footwear • Be aware of hard to grip and hold items that may force your hand or wrist into awkward, stressful positions and cause disorders like tendinitis or carpal tunnel syndrome • Take breaks when carrying items frequently and/or for long distances • Do not over reach when picking up or placing items. • Use the buddy system when necessary • When climbing ladders, maintain three points of contact at all times. DO NOT carry equipment up or down ladders unless it is in a secure backpack or similar hands-free shoulder-strap bag or case. Lower or raise larger equipment by crane or rope
Drilling Oversight/ Sampling	Contaminant Exposure, Noise, Contact with Utilities, Cuts/Scrapes, Heavy Lifting, Repetition, Slips/Trips/Falls	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses; Nitrile/neoprene gloves; and earplugs. • Confirm utility locate has been completed. • Confirm adequate clearance from overhead utilities. • Dispose of gloves after use and wash hands. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards. • If cutting through concrete, follow the work practices and respiratory protection recommended in **Table 1 of the GEI Silica Program based on the type of equipment being used to cut through the concrete.**

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Activity	Potential Hazard	Control Measures
Drum Handling	Contaminant Contact • Wear proper PPE during sampling including nitrile gloves and safety glasses. Cuts or Abrasions Heavy Lifting , Slips/Trips/Falls	• Wear proper PPE during sampling including nitrile gloves and safety glasses and face shield as appropriate. • Use proper dollies or drum moving tools. • Use applicable tools to open/close drum lids. • Do not handle drums with bulging sides. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Use proper lifting techniques. • Ask fellow worker for help. • Keep trafficked areas free from slip/trip/fall hazards. • See SOP HS-003
Excavation and Trenching Oversight	Crushing, entrapment, falls, fire/explosion	• Prior to excavating, determine utility locations and have locations marked by utility companies and the property owner. • Utilities shall be properly supported and barriers should be erected around excavations in remote areas. • Backfill temporary excavations when work is completed. • Personnel must remain 2 feet from the face of the excavation. • Sides, slopes, and faces shall meet OSHA requirements. • Excavation entry will be allowed only with proper sloping or shoring. • See **SOP HS-006**
Groundwater Sampling	Contaminant Exposure, Heavy Lifting, Repetition, Slips/Trips/Falls	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses and Nitrile/neoprene gloves. • Dispose of gloves after use and wash hands. • User proper lifting techniques. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.
Handling/Mixing Cement	Chemical exposure, heavy lifting	• Wear appropriate PPE including:, Waterproof gloves, a long-sleeved shirt, and long pants should be worn and safety glasses. • Use proper lifting techniques • Avoid prolonged contact with fresh concrete – contact with skin surfaces, eyes, and clothing may result in burns that are quite severe • Wash hands and arms immediately afterwards with clean water, non-alkaline soap, and clean towels. • Use all available work practices to control dust exposures.
Heavy Lifting	Back injury, knee injury	• Use proper lifting techniques. • Ask fellow worker for help. • Use a mechanical lifting device or a lifting aid where appropriate. • If you must lift, plan the lift before doing it. • Check your route for clearance. • Bend at the knees and use leg muscles when lifting. • Use the buddy system when lifting heavy or awkward objects. • Do not twist your body while lifting. • See SOP HS-025

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Activity	Potential Hazard	Control Measures
Heavy Equipment – Working Near	Struck-by, caught-in-between equipment, crushing, pinch points	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or (electrical hazard) EH-rated safety boots with composite toe and shank; safety glasses; nitrile/neoprene gloves; and earplugs. • Identify yourself and your work location to heavy equipment operators, so they may incorporate you into their operations. • Coordinate hand signals with operators. • Stay Alert! Pay attention to equipment backup alarms and swing radii. • Wear a high-visibility, reflective vest when working near equipment or motor vehicle traffic. • Position yourself in a safe location when filling out logs talking with the contractor. • Notify the contractor immediately if any problems arise. • Do not stand or sit under suspended loads or near any pressurized equipment lines. • Do not operate cellular telephones in the vicinity of heavy equipment operation. • See **SOP HS-018**
Non-Powered Hand Tools Use (loppers, pruning shears, machete, and honeysuckle hopper)	Cuts/Scrapes, Slips/Trips/Falls, Heavy Lifting, Repetition, caught-in-between equipment, pinch points	• Wear appropriate PPE including: gloves, steel toed/shank safety boots, safety glasses, high visibility reflective clothing, and hard hat (as necessary). • Keep hands away from pinch points or cutting parts • Use proper lifting techniques. • Do not remove equipment guards on equipment. • Take regular breaks and do not work in unusual positions for long periods of time. • Inspect equipment or tools prior to use. Tag and remove from service if tool is damaged.
Shift Hours or Night Operations	Fatigue, vehicle accident, injury	• Work shifts should not be greater than 12 hours. • Driving distance and time after a 12-hour shift should not exceed 30 miles or 30 minutes (whichever is greater). • Night operations will include proper lighting, security measures (phone, police detail, guards), sanitary facilities, food and water.
Soil Sampling/Soil Vapor Sampling	Contaminant Exposure, Cuts/Scrapes, Heavy Lifting, Repetition, Slips/Trips/Falls	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses; Nitrile/neoprene gloves; and earplugs as necessary. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Excavation entry will be allowed only with proper sloping or shoring. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.

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Activity	Potential Hazard	Control Measures
Waste Characterization	Contaminant Contact • Wear proper PPE during sampling including nitrile gloves and safety glasses. Cuts or Abrasions, Slips/Trips/Falls	• Wear proper PPE during sampling including nitrile gloves and safety glasses. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Keep trafficked areas free from slip/trip/fall hazards.

Personal Protective Equipment (PPE) is the initial level of protection based on the activity hazards and Site conditions which have been identified. Upgrades to respiratory protection may be required based on the designated Action Levels found in Section 9. General on-site provisions will include: extra nitrile, leather, and/or Kevlar gloves, extra protective coveralls (e.g. Tyvek®) with boot covers, drinking water and electrolyte fluids, reflective vest, first aid kit, fire extinguisher, hearing protection, and washing facilities.

If Site conditions suggest the existence of a situation more hazardous than anticipated, the Site personnel will evacuate the immediate area. The hazard, the level of precautions, and the PPE will then be reevaluated with the assistance and approval of the CHSO (Steven Hawkins) and the Project Manager (PM) Melissa Felter.

4.2.1 Handling Drums and Containers

Regulations for handling drums and containers are specified by Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(j). Potential hazards associated with handling drums include vapor generation, fire, explosions, and possible physical injury. Handling of drums/containers during the Site investigation and remediation activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with applicable regulations.

4.2.2 Utilities

The Site may have shallow, buried utilities and also overhead utilities in certain areas. It will be necessary for parties disturbing the existing ground surface and conducting operations with heavy equipment having high clearances to exercise caution in performing project-related work with respect to the presence of utilities. Utility companies with active, buried lines in the Site area will be asked by the Contractor performing intrusive activities to mark their facilities. Employees will use these data to choose work locations.

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4.2.2.1 Underground Utilities

No excavating, drilling, boring, or other intrusive activities will be performed until an underground utility survey, conducted by knowledgeable persons or agencies, has been made. This survey will identify underground and in-workplace utilities such as the following:

- Electrical lines and appliances;
- Telephone lines;
- Cable television lines;
- Gas lines;
- Pipelines;
- Steam lines;
- Water lines;
- Sewer lines; and/or
- Pressurized air lines.

Please refer to GEI's SOP HS-014 Utility Mark Out (Appendix E) and Con Edison's – Utility Clearance Process for Intrusive Activities – Corporate EH&S Remediation Program (Appendix F). Dig Safely New York (Call 811) will be contacted to mark out utilities at the Site address prior to start of any intrusive activities. Be sure to have receipt of a utility mark out across the entire work area. Look for visible evidence of utility markings on the ground in the form of painted identifications for sewer, water, gas, communications, storm water, oil or petroleum, etc. It is required that prior to drilling, hand excavation occur, to minimally, 5 feet below ground surface, to pre-clear locations from utilities.

The location of utilities will be discussed with GEI employees and subcontractors during a Site Safety Briefing. Identified utilities should be marked or access otherwise restricted to avoid chance of accidental contact.

Even when a utility search has been completed, drilling, boring, and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. Utilities will be considered "live" or active until reliable sources demonstrate otherwise.

4.2.2.2 Overhead Utilities

Overhead transmission and distribution lines will be carried on towers and poles which provide adequate safety clearance over roadways and structures. Clearances will be adequate for the safe movement of vehicles and for the operation of construction equipment.

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Overhead or above-ground electric lines should be considered active until a reliable source has documented them to be otherwise. Elevated work platforms, ladders, scaffolding, man-lifts, and drill or vehicle superstructures will be erected a minimum of 20 feet (the actual distance is dependent upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded, or shielded so arcing cannot occur between the work location or superstructure.

4.2.3 Excavations and Trenches

The safety requirements for excavations and trenches must be determined by a competent person who is capable of identifying existing and predictable hazards and work conditions that are unsanitary, hazardous, or dangerous to GEI employees. The competent person must also have the authorization to take prompt corrective measures to eliminate unsatisfactory conditions. GEI employees will not enter trenches.

The following are general requirements for work activities in and around excavations:

- Prior to initiation of excavation activity (or ground intrusive activity, such as drilling), the location of underground installations will be determined. The New York 811 at 811 or 1-800-272-4480 will be contacted by the Contractor/Subcontractor a minimum of 72 hours prior to excavation activities. It may also be necessary to temporarily support underground utilities during excavation. When excavations approach the estimated location of underground installations, the exact location of the underground installations will be determined by means that are safe for GEI employees, i.e., hand dig, test pits, etc.
- Excavations should be inspected daily by the excavating company's competent person prior to commencement of work activities. Evidence of cave-ins, slides, sloughing, or surface cracks or excavations will be cause for work to cease until necessary precautions are taken to safeguard employees.
- Excavated and other materials or equipment that could fall or roll into the excavation, and vehicular traffic and heavy equipment will be placed at least 5 feet from the edge of the excavation.
- Excavation operations will cease immediately during hazardous weather conditions such as high winds, heavy rain, lightning, and heavy snow.

Employees will refer to GEI's Excavation Safety SOP for further information.

4.2.4 Fire and Explosion

When conducting excavating activities, the opportunity for encountering fire and explosion hazards exists from contamination in soil and the possibility of free product in underground

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structures and pipelines. Additionally, the use of diesel-powered excavating equipment could present the possibility of encountering fire and explosion hazards.

4.2.5 Heat Stress

Employees may be exposed to the hazards associated with heat stress when ambient temperatures exceed 70ºF. Employees should increase water intake while working in conditions of high heat. Enough water should be available so that each employee can consume 1 quart of water per hour. In addition, they should increase number of rest breaks and/or rotate employees in shorter work shifts. Employees should rest in cool, dry, shaded areas for at least 5 minutes. Employees should not wait until they feel sick to cool down. Watch for signs and symptoms of heat exhaustion and fatigue. In the event of heat stroke, bring the victim to a cool environment, call for help, and initiate first aid procedures

The procedures to be followed regarding avoiding heat stress are provided in Appendix C – Heat Stress Guidelines and in GEI's Heat Stress program.

4.2.6 Cold Stress

Employees may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia, as well as slippery surfaces, brittle equipment, and poor judgment. The procedures to be followed regarding avoiding cold stress are provided in Appendix C – Cold Stress Guidelines and in GEI's Cold Stress program.

4.2.7 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. Employees who will perform suspected or established high noise tasks and operations will wear hearing protection. If deemed necessary by the SSO, the CHSO will be consulted on the need for additional hearing protection and the need to monitor sound levels for Site activities. Other employees who do not need to be in proximity of the noise should distance themselves from the equipment generating the noise.

4.2.8 Hand and Power Tools

In order to complete the various tasks for the project, personnel may use hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Work gloves, safety glasses, and hard hats will be worn by the operating personnel when using hand and power tools and Ground Fault Circuit Interrupter (GCFI)-equipped circuits will be used for power tools.

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4.2.9 Slips, Trips, and Falls

Working in and around the Site may pose slip, trip, and fall hazards due to slippery and uneven surfaces. Excavation at the Site may cause uneven footing in trenches and around the soil piles. Steep slope and uneven terrain conditions at the Site are also a primary concern. GEI employees will wear proper foot gear and will employ good work practice and housekeeping procedures to minimize the potential for slips, trips, and falls.

4.2.10 Manual Lifting

Manual lifting of objects and equipment may be required. Failure to follow proper lifting technique can result in back injuries and strains. Employees should use a buddy system and/or power equipment to lift heavy loads whenever possible and should evaluate loads before trying to lift them (i.e., they should be able to easily tip the load and then return it to its original position). Carrying heavy loads with a buddy and proper lifting techniques include: 1) make sure footing is solid; 2) make back straight with no curving or slouching; 3) center body over feet; 4) grasp the object firmly and as close to your body as possible; 5) lift with legs; and 6) turn with your feet, don't twist.

4.2.11 Projectile Objects and Overhead Dangers

Overhead dangers, including but not limited to falling debris and equipment, can occur while operating drill rigs. GEI employees will maintain a minimum distance from large overhead operations and to maintain proper communication with heavy equipment operators and their handlers, should work necessitate their presence beyond the minimum safety distance. Proper PPE will be worn during these types of activities including steel-toed/shank boots, safety vests, and hard hats.

4.2.12 Cuts and Lacerations

The core sampling program may require employees to use powered cutting tools (circular saw or shears) or a hooked knife to cut open the sample liner. Safety box cutters will be utilized for routine operations such as opening boxes of supplies or cutting rope or string. When using cutting tools, follow the safety precautions listed below:

- Keep free hand out of the way.
- Secure work if cutting through thick material.
- Use only sharp blades; dull blades require more force that results in less knife control.
- Pull the knife through the object but away from your body; pulling motions are easier to manage.
- Do not put the knife in your pocket.

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- Wear leather or Kevlar® gloves when using knives or blades, or when removing sharp objects caught or dangling in sampling gear.

4.3 Chemical Hazards

The characteristics of compounds at the Site are discussed below for information purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below.

4.3.1 Volatile Organic Compounds (VOCs)

Volatile organic chemicals (VOCs), such as benzene, toluene, ethyl benzene, and xylene (BTEX) are present as soil and groundwater contaminants, and in some cases chemical components in non-aqueous phase liquids (NAPL) such as oil or tar within soils and abandoned pipelines. These compounds are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. These compounds generally have a depressant effect on the Central Nervous System (CNS), may cause chronic liver and kidney damage, and some are suspected human carcinogens. Benzene is a known human carcinogen. Acute exposure may include headache, dizziness, nausea, and skin and eye irritation. The primary route of exposure to VOCs is through inhalation and therefore respiratory protection is the primary control against exposure to VOCs.

4.3.2 Coal Tar and Coal Tar Products

Coal tar products, which are semi-volatile organic compounds (SVOCs) consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluorethene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)peryline, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphththalene, phenanthrene, phenols, pyrene.

Coal tar products and other SVOCs are present at the Site within impacted soil and groundwater and as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former manufactured gas plant (MGP) structures, and abandoned pipelines.

Coal tar products such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling, and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Coal tar is considered to be very toxic, if ingested. High levels of exposure to coal tar, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney, and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever, anemia, liver damage, vomiting, convulsions, and coma. Poisoning may occur by ingestion of large doses, inhalation, or skin absorption.

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The major route of entry for the work activities to be conducted at this Site is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

4.3.3 Heavy Metals

The subsurface soil may contain elevated levels of metals including: arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium, and zinc.

Exposure to high concentrations of arsenic can cause dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, and hyper pigmentation of skin. Chronic exposure to arsenic has resulted in lung cancer in humans.

Exposure to high concentrations of beryllium can result in "beryllium sensitization", which is an allergic response to beryllium. Symptoms of the disease include cough, shortness of breath, fatigue, fevers, skin rash, and night sweats. In the later stages, lung tissue becomes scarred. In severe cases, the right side of the heart may be strained due to increased pressure in the pulmonary artery from lung damage.

Exposure to high concentrations of cadmium can cause acute symptoms such as pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness and pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; loss of the sense of smell), mild anemia; and is considered a potential occupational carcinogen.

Exposure to chromium can cause acute symptoms such as irritation of the eyes, nose and throat as well as wheezing and coughing. Chronic effects include nosebleeds, nasal congestion, dermatitis, and loss of sight.

Exposure to high concentrations of copper through inhalation can cause irritation of the eyes, nose, pharynx, nasal septum. Ingestion may cause a metallic taste. Skin irritation may result from direct contact with skin. Damage to the liver and kidneys may occur.

Exposure to lead may cause acute symptoms such as eye irritation, weakness, weight loss, abdominal pain, and anemia. Chronic exposure to lead may result in kidney disease, effects to the reproductive system, blood forming organs, and CNS.

Lead and arsenic are regulated by specific OSHA standards. They are 29 CFR 1910.1025/1926.52 and 29 CFR 1910.1018/1926.1118, respectively. These standards include specific requirements for air monitoring, signs and labels, training and medical surveillance.

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Exposure to high concentrations of nickel may cause sensitization dermatitis, allergic asthma, and pneumonitis. Exposure to mercury can cause dizziness, salivation nausea, vomiting, diarrhea, constipation, emotional disturbance, and kidney injury. Chronic exposure to mercury can cause CNS damage.

Exposure to high concentrations of selenium can cause mucous membrane irritation, coughing, sneezing, shortness of breath, chills, headaches, hypotension, and CNS depression. Chronic exposure to selenium could cause bronchial irritation, gastrointestinal distress, excessive fatigue, and skin discoloration.

Exposure to high concentrations of thallium can cause nausea, diarrhea, abdominal pain, vomiting; tremor; chest pain, pulmonary edema; convulsions, psychosis; liver, kidney damage; and alopecia.

Exposure to high concentrations of zinc through ingestion can cause abdominal pain, nausea, vomiting, and diarrhea. Chronic exposure can lead to low blood pressure, jaundice, and seizures.

These metals are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. As with SVOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

4.3.4 Polychlorinated Biphenyls

It is not likely that polychlorinated biphenyls (PCBs) are of concern based on previous land uses at the Site. PCBs have historically been used from a number of sources including, but not limited to; electrical systems, hydraulic oils, lubricants, cutting oils, printer's ink, and asphalt. Exposure to PCBs can occur through unbroken skin without immediate pain or irritation. PCBs detected at the site are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. Acute effects of exposure to high concentrations of PCB can include eye, skin, nose, and throat irritation. Chronic effects of PCB exposure can include skin swelling and redness, gastro-intestinal disturbances, and neurological effects such as headache, dizziness, nervousness, and numbness of extremities. PCBs are suspected human carcinogens that can cause liver cancer. PCBs can accumulate in fatty tissues and result in health effects after the initial exposure has occurred. The primary route of exposure for PCBs is inhalation, dermal contact, and ingestion. Analysis of soils from the Site did not indicate elevated PCB concentrations.

4.3.5 Hydrogen Sulfide

Hydrogen sulfide is another common by-product of manufactured gas production and is also associated with the breakdown of sewage by bacteria in sewer pipes. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and

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fluid in the lungs. These symptoms usually go away in a few weeks. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Breathing very high levels (> 800 parts per million [ppm]) of hydrogen sulfide can cause death within just a few breaths. The primary route of exposure is through inhalation and therefore respiratory protection is the primary control against exposure to hydrogen sulfide.

4.3.6 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when PPE must be upgraded or changed. Action Levels for VOCs and associated contingency plans for the work zone are discussed within Section 9 of this HASP. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the specific agency approved Work Plan.

Exposure to organic vapors will be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photoionization detector (PID) or a flame ionization detector (FID).
- When possible, engineering control measures will be utilized to suppress the volatile organic vapors. Engineering methods can include utilizing a fan to promote air circulation, utilizing volatile suppressant foam, providing artificial ground cover, or covering up the impacted material with a tarp to mitigate volatile odors.
- When volatile suppression engineering controls are not effective and organic vapor meters indicate concentrations above the action levels, then appropriate respiratory protection (i.e., air purifying respirator with organic vapor cartridge) will be employed.

4.3.7 Evaluation of Respirable Dust Inhalation

Inhalation of respirable dust containing metals, asbestos, and SVOCs is possible when surrounding ground cover is disturbed by heavy equipment, conducting demolition work, or using power tools on surfaces that contain these materials. Contaminated particulate matter (soil, pavement, lead paint, insulation, etc.) becomes suspended in air due to a combination of factors including lack of vegetative cover and/or dry or dusty conditions. Air monitoring reduces the risk of overexposure to respirable dust inhalation by indicating when action levels have been exceeded and when PPE must be upgraded or changed. Action levels for respirable dust and associated contingency plans for the work zone and perimeter of the Site are discussed within Section 7 of this HASP.

Control of respirable dust shall be conducted at this Site as follows:

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- When possible, dust control measures will be utilized to suppress the dust. These methods include wetting down the area, providing artificial ground cover, or covering up the material with a tarp.
- When dust suppression is not possible and respirable dust meters indicate concentrations above the action levels, respiratory protection must be used to prevent against inhalation of contaminated dusts.

4.3.8 Evaluation of Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of proper hygiene practices, PPE, and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves, safety glasses) as described in Section 5 will be worn for activities where contact with potential contaminated media or materials are expected.

SDSs for decontamination chemicals and laboratory reagents that may be used on Site are included in Appendix B. Specific chemical hazards information from the occupational health sources are summarized in Table 3.

4.3.9 Other Chemical Hazards

Chemicals not identified in this HASP may be used during the Site characterization activities. Prior to the initiation of any on-site tasks, each Contractor, Subcontractor, or Consultant shall provide Safety Data Sheets (SDS) to the SSO for each of the chemicals to be used. The SDS will be maintained at the Site by the SSO and all Site workers and visitors who may potentially be exposed to the chemicals will be made aware of these hazards and the location of the on-site SDSs during a hazard briefing session by the SSO. SDS of commonly used compounds are located in Appendix B. Only Con Edison approved chemicals/products may be used/stored at the Site.

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Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3 A.L. .005mg/m3	Inhalation Skin Absorption Ingestion Skin Contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 ppm TWA 5 ppm STEL	Inhalation Skin Absorption Ingestion Skin Contact	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea; staggering gait, fatigue, anorexia, weakness, dermatitis, bone marrow depression, potential carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12^o F IP: 9.24 eve LEL: 1.2% UEL:7.8% VP: 75 mm
Beryllium	7440-41-7	NIOSH REL: Ca C 0.0005 mg/m3	TWA 0.002 mg/m3 C 0.005 mg/m3 (30 minutes), with a maximum peak of 0.025 mg/m3	Inhalation, skin and/or eye contact	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen]	Eyes, skin, respiratory system	A hard, brittle, gray-white solid.. FP: none LEL:N/A UEL: N/A VP: 0 mm
Cadmium	7440-43-9 (metal)	CA	TWA 0.005 mg/m^3	Inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Respiratory system, kidneys, prostate, blood; **Cancer Site** [prostatic & lung cancer]	Silver-white, blue-tinged lustrous, odorless solid. FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm

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Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Chromium (Chromic Acid and Chromates)	1333-82-0	0.05 mg/m^3	0.1 mg/m^3	Inhalation Ingestion Skin Contact	Irritates respiratory system, nasal, septum perforation, liver and kidney damage, leucocytosis (increased blood leucocytes), leukopenis (reduced blood leucocytes), monocytosis (increased monocytes), Eosinophilia, eye injury, conjunctivitis, skin ulcer, sensitivity dermatitis, potential carcinogen	Blood, respiratory system, liver, kidney, eyes, skin, lung cancer	FP:NA IP:NA VP: Very Low LEL: NA UEL: NA
Copper (as a fume)	1317-38-0	NIOSH REL: TWA 0.1 mg/m3	TWA 0.1 mg/m3	Inhalation, skin and/or eye contact	Irritation eyes, upper respiratory system; metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough, lassitude (weakness, exhaustion); metallic or sweet taste; discoloration skin, hair	Eyes, skin, respiratory system (increased risk with Wilson's disease)	Finely divided black particulate dispersed in air FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Ethylbenzene	100-41-4	100 ppm	100 ppm	Inhalation Ingestion Skin Contact	Eye, skin, mucous membrane irritation; headache; dermatitis, narcosis; coma	Eyes, skin, respiratory system, CNS	FP: 55º F IP: 8.76 eV LEL: 0.8% UEL:6.7% VP: 7 mm
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/Eye Contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, CNS	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm IP: 10.46 eV
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m3	Inhalation Ingestion Skin Contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, CNS, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm

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Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m3	Inhalation Ingestion Skin Contact Skin Absorption	Irritates eyes and skin, chest pain, cough, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, Gastrointestinal disturbance, weight loss, proteinuria	Eyes, skin, respiratory tract, central nervous system	Silver-white, heavy odorless liquid FP: NA IP:? LEL: NA UEL:NA VP: 0.0012 mm
Nickel	7440-02-0 (Metal)	NIOSH REL*: Ca TWA 0.015 mg/m3 [*Note: The REL does not apply to Nickel carbonyl.]	TWA 1 mg/m3 [*Note: The PEL does not apply to Nickel carbonyl.]	Inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Nasal cavities, lungs, skin **Cancer Site:** **[lung and nasal cancer]**	Metal: Lustrous, silvery, odorless solid FP: none LEL:N/A UEL: N/A VP: 0 mm
PCBs	11097-69-1	0.5 mg/m^3 (Skin)	0.5 mg/m^3 (Skin)	Inhalation Skin Absorption Ingestion Skin Contact	Irritate eyes; chloracne; liver damage;	Skin, eyes, liver, reproductive system	Colorless liquid or solid with a mild, hydro-carbon odor VP = 0.00006 mm
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Ingestion Skin Contact	Irritant to eyes, skin, nose and throat, visual disturbance, headache, chills, fever, breathing difficulty, bronchitis, metallic taste, garlic breath, GI disturbance, dermatitis, eye and skin burns,	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amphorous or crystalline, red to gray solid FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm

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Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Thallium		NIOSH REL: TWA 0.1 mg/m3 [skin]	OSHA PEL: TWA 0.1 mg/m3 [skin]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eyes, respiratory system, central nervous system, liver, kidneys, gastrointestinal tract, body hair	Properties vary depending upon the specific soluble thallium compound.
Toluene	108-88-3	50 ppm	200 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, nose irritation; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, tearing of eyes; nervousness, muscle fatigue, insomnia, tingling in limbs; dermatitis	Eyes, skin, respiratory system, CNS, liver, kidneys	FP: 40º F IP: 8.82 eV LEL: 1.1% UEL:7.1% VP: 21 mm
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion, Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; incoordination, staggering gait; corneal damage; appetite loss, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, Central Nervous System, GI tract, blood, liver, kidneys	FP: 90º F LEL: 0.9% UEL: 6.7% VP: 9 mm
Zinc	1314-13-2	5 mg/m3 (TWA), 10 mg/m3 (STEL) for zinc oxide fume	10 mg/m3 (TWA), for zinc oxide fume	Inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Respiratory system	Colorless liquid FP: NA? IP: 11 eV LEL: 7.5% UEL: 12.5% VP: 100 mmHg

Abbreviations:

°F = degrees Fahrenheit
ACGIH = American Conference of Industrial Hygienists
A.L. = Action Level
atm = atmosphere
C = ceiling limit, not to be exceeded
IP = Ionization Potential
LEL = Lower explosive limit
mg/m^3 = micrograms per cubic meter
min = minute
mm = millimeter

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Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data

CAS # = chemical abstract services number
CNS = Central Nervous System
CTPV = Coal Tar Pitch Volatiles
CVS = Cardiovascular System
eV = electron volt
f/cc = fibers per cubic centimeter
FP = Flash point
GI = Gastro-intestinal
H2S = Hydrogen Sulfide
HCN = Hydrogen Cyanide
hr = hour
mmHg = millimeters of mercury
N/A = not applicable
OSHA = Occupational Safety and Health Administration
PAH = Polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyls
PEL = Permissible exposure limit
ppm = parts per million
Skin = significant route of exposure
STEL = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure approximately 68°F in mm Hg

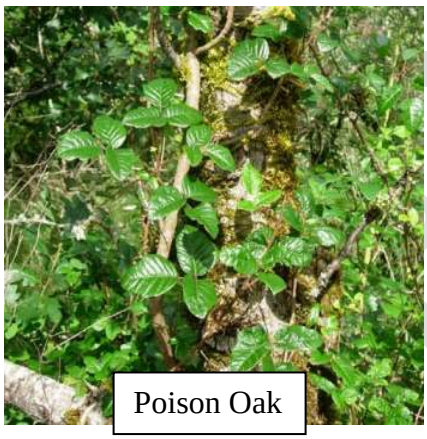
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4.4 Biological Hazards

Areas of the Site may be wooded, surrounded with brush, or landscaped. Therefore, employees working on this project should be aware of the potential biological hazards at this Site. Each is discussed in detail below:

4.4.1 Poisonous Plants

Persons working on the Site should be aware of the possible presence of poisonous plants and insects. Poison ivy is a climbing plant with leaves that consist of three glossy, greenish leaflets. Poison ivy has conspicuous red foliage in the fall. Small yellowish-white flowers appear in May through July at the lower leaf axils of the plant. White berries appear from August through November. Poison ivy is typically found east of the Rockies. Poison oak is similar to poison ivy but its leaves are oak-like in form. Poison oak occurs mainly in the south and southwest. Poison sumac typically occurs as a small tree or shrub and may be 6 to 20 feet in height. The bark is smooth, dark and speckled with darker spots. Poison sumac is typically found in swampy areas and east of the Mississippi. The leaves have 7 to 13 smooth-edged leaflets and drooping clusters of ivory-white berries that appear in August and last through spring.



Poison Oak



Poison Ivy



Poison Sumac

The leaves, roots, stems and fruit of these poisonous plants contain urushiol. Contact with the irritating oil causes an intensely itching skin rash and characteristic, blister-like lesions. The oil can be transmitted on soot particles when burned and may be carried on the fur of animals, equipment, and apparel.

Proper identification of these plants is the key to preventing contact and subsequent dermatitis. Wear long sleeves and pants when working in wooded areas. In areas of known infestation, wear Tyvek® coveralls and gloves. Oils are easily transferred from one surface to another. If you come in contact with these poisonous plants, wash exposed areas immediately with cool water to remove the oils. Some commercial products such as Tecnu's Poison Oak-n-Ivy Cleanser claim to further help with the removal of oils.

4.4.2 Ticks

4.4.2.1 Lyme Disease

Ticks are bloodsuckers, attaching themselves to warm-blooded vertebrates to feed. Deer ticks are associated with the transmission the bacteria that causes Lyme disease. Female deer ticks are about ¼-inch in length and are black and brick red in color. Males are smaller and all black. If a tick is not removed, or if the tick is allowed to remain for days feeding on human blood, a condition known as tick paralysis can develop. This is due to a neurotoxin, which the tick apparently injects while engorging. This neurotoxin acts upon the spinal cord causing incoordination, weakness, and paralysis.

The early stages of Lyme disease, which can develop within a week to a few weeks of the tick bite, are usually marked by one or more of these signs and symptoms:

- Tiredness
- Chills and fever
- Headache
- Muscle and/or join pain
- Swollen lymph glands
- Characteristic skin rash (i.e. bullseye rash)

4.4.2.2 Rocky Mountain Spotted Fever

Rocky Mountain spotted fever is spread by the American dog tick, the lone-star tick, and the wood tick, all of which like to live in wooded areas and tall, grassy fields. The disease is most common in the spring and summer when these ticks are active, but it can occur anytime during the year when the weather is warm.

Initial signs and symptoms of the disease include sudden onset of fever, headache, and muscle pain, followed by development of a rash. Initial symptoms may include fever, nausea, vomiting, severe headache, muscle pain, and/or lack of appetite.

The rash first appears 2 to 5 days after the onset of fever and is often not present or may be very subtle. Most often it begins as small, flat, pink, non-itchy spots on the wrists, forearms,

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and ankles. These spots turn pale when pressure is applied and eventually become raised on the skin. Later signs and symptoms include rash, abdominal pain, joint pain, and/or diarrhea.

The characteristic red, spotted rash of Rocky Mountain spotted fever is usually not seen until the 6th day or later after onset of symptoms, and this type of rash occurs in only 35% to 60% of patients with Rocky Mountain spotted fever. The rash involves the palms or soles in as many as 50% to 80% of patients; however, this distribution may not occur until later in the course of the disease.

4.4.2.3 Prevention

Tick season lasts from April through October; peak season is May through July. You can reduce your risk by taking these precautions:

- During outside activities, wear long sleeves and long pants tucked into socks. Wear a hat, and tie hair back.
- Use insecticides to repel or kill ticks. Repellents containing the compound n,n-diethyl-meta-toluamide (DEET) can be used on exposed skin except for the face, but they do not kill ticks and are not 100% effective in discouraging ticks from biting. Products containing permethrin kill ticks, but they cannot be used on the skin -- only on clothing. When using any of these chemicals, follow label directions carefully.
- After outdoor activities, perform a tick check. Check body areas where ticks are commonly found: behind the knees, between the fingers and toes, under the arms, in and behind the ears, and on the neck, hairline, and top of the head. Check places where clothing presses on the skin.
- Remove attached ticks promptly. Removing a tick before it has been attached for more than 24 hours greatly reduces the risk of infection. Use tweezers, and grab as closely to the skin as possible. Do not try to remove ticks by squeezing them, coating them with petroleum jelly, or burning them with a match. Keep ticks in a zip-lock baggie in case testing needs to be performed.

Report any of the above symptoms and all tick bites to the PM and Safety Team for evaluation.

4.4.3 Mosquito- Borne Disease – West Nile Virus

West Nile encephalitis is an infection of the brain caused by the West Nile virus, which is transmitted by infected mosquitoes. Following transmission from an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal CNS functioning and causes inflammation of the brain tissue. However, most infections are mild and symptoms include fever, headache, and body aches. More severe infections may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness,

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paralysis, and rarely, death. Persons over the age of 50 have the highest risk of severe disease.

Prevention centers on public health action to control mosquitoes and on individual action to avoid mosquito bites. Any individuals who have been bitten or stung by an insect shall notify the SSO and the Con Edison Construction Representative immediately. To avoid being bitten by the mosquitoes that cause the disease, use the following control measures:

If possible, stay inside between dusk and dark. This is when mosquitoes are most active. When outside (between dusk and dark), wear long pants and long-sleeved shirts. Spray exposed skin with an insect repellent, preferably containing DEET.

4.4.4 Wasps and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer, or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once while wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers. Some people may develop an allergic reaction (i.e. anaphylactic shock) to a wasp or bee sting. If such a reaction develops, seek medical attention at once. If a GEI employee is allergic to bees or wasps notify the SSO and if, needed, the location of the epi pen. Any individuals who have been bitten or stung by an insect shall notify the SSO and the Con Edison Construction Representative immediately.

4.4.5 Sun Exposure

Employees are encouraged to liberally apply sunscreen, with a minimum sun protection factor (SPF) of 15, when working outdoors to avoid sunburn and potential skin cancer, which is associated with excessive sun exposure to unprotected skin. Additionally, employees should wear safety glasses that offer protection from ultraviolet A and B (UVA/UVB) rays.

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5. Personal Protective Equipment

The PPE specified in Table 4 represents PPE selection required by 29 CFR 1910.132, and is based on the Activity Hazard Analysis of Section 4 (Table 2). Specific information on the selection rationale activity can be found in the GEI Health and Safety Manual.

The PPE program addresses elements, such as PPE selection based on Site hazards, use and limitations, donning and doffing procedures, maintenance and storage, decontamination and disposal, training and proper fitting, inspection procedures prior to / during / and after use, evaluation of the effectiveness of the PPE program, and limitations during temperature extremes, heat stress, and other appropriate medical considerations. A summary of PPE for each level of protection is in Table 4.

Table 4. Site-Specific PPE

Task	PPE Level	Site-Specific Requirements	Respirator
Mobilization/Demobilization			
Reconnaissance	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Mobilization/Demobilization of Equipment and Supplies	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D – None
Establishment of Site Security, Work Zones, and Staging Area	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Investigation/Construction			
Drilling,Groundwater Well Installation, Excavation, Backfilling, Sampling, Monitoring Well Repair	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)
Remediation Observation			
Observe Contractor Activities	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)

Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the Site and this HASP will be revised with oversight of the CHSO or GEI personnel will not re-enter the Site until conditions allow.

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For most work conducted at the site, Level D PPE will include long pants, hard hats, safety glasses with side shields, and steel toe/shank or EH-rated safety boots. When work is conducted in areas where non-aqueous phase liquid (NAPL) or tar-saturated soil is anticipated, employees will wear, at a minimum, Level D PPE, which can include Tyvek® coveralls and safety boots with overboots.

5.1 OSHA Requirements for PPE

Personal protective equipment used during the course of this field investigation must meet the following OSHA standards:

Table 5. OSHA Standards for PPE

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1 1968
Respiratory	29 CFR 1910.134	ANSI Z88.1 1980
Head	29 CFR 1910.135	ANSI Z89.1 1969
Foot	29 CFR 1910.136	ANSI Z41.1 1999 or ASTM F-2412-2005, and ASTM F-2413-2005

CRF = Code of Federal Regulations
ANSI = American National Standards Institute
ASTM = American Society For Testing and Materials

On-site GEI personnel who have the potential to don a respirator must have a valid fit test certification and documentation of medical clearance. The CHSO will maintain such information on file for on-site personnel. The PM will obtain such information from the subcontractor's site supervisor prior to the initiation of such work. Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.134). Air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency (less than 20.7%).
- Imminent Danger to Life and Health (IDLH) concentrations.
- If contaminant levels exceed designated use concentrations.

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6. Key Project Personnel/Responsibilities and Lines of Authority

6.1 GEI Personnel

- Melissa Felter, P.G — Project Manager
- Matthew O'Neil, P.E — Project Engineer
- Mathew Sandefur — Site Safety Officer
- Steven Hawkins — Corporate Health and Safety Officer
- Jenna Sheppard — Regional Health and Safety Officer

The implementation of health and safety at this project location will be the shared responsibility of the PM, the CHSO, the SSO, other GEI personnel implementing the proposed scope of work.

6.1.1 GEI Project Manager

The PM, Melissa Felter, is responsible for confirming that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Conducting and documenting the Project Safety Briefing for GEI project employees and forwarding the signed form (Appendix D) to the Health and Safety Committee;
- Verifying that the GEI staff selected to work on this program are sufficiently trained for Site activities;
- Assuring that personnel to whom this HASP applies, including subcontractor personnel, have received a copy of it;
- Providing the CHSO with updated information regarding conditions at the Site and the scope of Site work;
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of necessary safety procedures;
- Supporting the decisions made by the SSO and CHSO;
- Maintaining regular communications with the SSO and, if necessary, the CHSO;
- Verifying that the subcontractors selected by GEI to work on this program have completed GEI environmental, health and safety requirements and has been deemed acceptable for the proposed scope of work; and
- Coordinating the activities of GEI subcontractors and confirming that they are aware of the pertinent health and safety requirements for this project.

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6.1.2 GEI Corporate Health and Safety Officer

The CHSO, Steven Hawkins, is the individual responsible for the review, interpretation, and modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the CHSO. Specific duties of the CHSO include:

- Writing, approving, and amending the HASP for this project;
- Advising the PM and SSO on matters relating to health and safety on this Site;
- Recommending appropriate PPE and safety equipment to protect personnel from potential Site hazards;
- Conducting accident investigations; and
- Maintaining regular contact with the PM and SSO to evaluate Site conditions and new information which might require modifications to the HASP.

6.1.3 GEI Site Safety Officer

GEI field staff are responsible for implementing the safety requirements specified in this HASP. However, one person will serve as the SSO. For this program, Mathew Sandefur will serve as the SSO. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Conducting/attending the Project Safety Briefing prior to beginning work, and subsequent safety meetings as necessary;
- Conduct daily Safety Tailgate meeting in accordance with Con Edison requirements (can be combined with "pre-entry") briefing for Site-related work;
- Verifying that personnel to whom this HASP applies have attended and participated in the Project Safety Briefing and subsequent safety meetings that are conducted during the implementation of the program;
- Maintaining a high level of health and safety consciousness among employees implementing the proposed activities;
- Procuring the air monitoring instrumentation required and performing air monitoring for investigative activities;
- Procuring and distributing the PPE and safety equipment needed for this project for GEI employees;

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- Verifying that PPE and health and safety equipment used by GEI is in good working order;
- Verifying that the selected contractors are prepared with the correct PPE and safety equipment and supplies;
- Notifying the PM of noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Monitoring and controlling the safety performance of personnel within the established restricted areas to confirm that required safety and health procedures are being followed;
- Stopping work in the event that an immediate danger situation is perceived; and
- Reporting accident/incident and preparing accident/incident reports, if necessary.

6.1.4 GEI Field Personnel

GEI field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading and signing the HASP in its entirety prior to the start of on-site work;
- Attending and actively participating in the required Project Safety Briefing prior to beginning on-site work and any subsequent safety meetings that are conducted during the implementation of the program;
- Stopping work in the event that an immediate danger situation is perceived;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the SSO, prior to the start of work;
- Reporting accidents, injuries, and illnesses, regardless of their severity, to the SSO, CHSO, and HR; and
- Complying with the requirements of this HASP and the requests of the SSO.

6.1.5 Lines of Authority will be as follows:

On Site – GEI will have responsibility for safety of its employees during the work performed at the Former Woodworth Avenue Works. GEI's field representative will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. GEI's field representative will be available for communication with the GEI PM and with the Con Edison representative.

GEI employees have the authority to stop work activities if an unanticipated hazard is encountered or a potential unsafe condition is observed. The GEI employee should

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contact the Corporate Health and Safety Officer and the Project Manager to discuss the stop work conditions and potential control methods that can be implemented.

6.2 Subcontractors

GEI requires its subcontractors to work in a responsible and safe manner. Subcontractors for this project will be required to develop their own HASP for protection of their employees, but, at a minimum, must adhere to applicable requirements set forth in this HASP.

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7. Training Program

7.1 HAZWOPER Training

In accordance with OSHA Standard 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response" (HAZWOPER) responders will, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training will have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training will not be allowed to work in any Site activities in which they may be exposed to hazards (chemical or physical). Proof of training will be submitted to the PM or his/her representative prior to the start of field activities. Copies of training documentation will be given to the Con Edison Construction Representative and will be retained onsite by GEI Staff.

7.2 Annual 8-Hour Refresher Training

Annual 8-hour refresher training will be required of hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current 8-hour refresher training will be submitted to the PM or his/her representative prior to the start of field activities. Copies of training documentation will be given to the Con Edison Construction Representative and will be retained onsite by GEI Staff.

7.3 Supervisor Training

Personnel acting in a supervisory capacity will have received 8 hours of instruction in addition to the initial 40-hour training. In addition supervisors will have 1 year of field experience and training specific to work activities (i.e., sampling, construction observation, etc.)

7.4 Site-Specific Training

Prior to commencement of field activities, the PM or the SSO will verify GEI field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the Site operations. It will include Site and facility layout, hazards, and emergency services at the Site, and will highlight the provisions contained within this HASP and applicable GEI H&S SOPs (Appendix E). This training will be documented on the Project Safety Briefing Form Appendix D). The signed form will be forwarded to the Safety Team at SafetyTeam@geiconsultants.com.In addition, GEI personnel will sign the

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plan to document that they understand the hazards and control measures presented and agree to comply with the procedures established in the HASP. Personnel that have not received project-specific training will not be allowed on-site. Copies of documentation of GEI's full HASP review to all workers on Site shall be given to the Con Edison Construction Inspector on Site.

7.5 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by the SSO or field representative to assist GEI personnel in safely conducting work activities. The briefing will include GEI subcontractors. The briefings can include information on new operations to be conducted, changes in work practices, or changes in the Site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. Documentation of these briefings will be recorded in the GEI field book, if the project duration is less than 5 days. If the project is longer than 5 days, the Tailgate Safety Briefing Form (Appendix D) will be used to document briefings. The meetings will also be an opportunity to periodically update the employees on monitoring results.

Copies of documentation of each day's pre-job safety briefings shall be given to the Con Edison Construction Inspector on Site.

Additionally, should an incident occur on Site, Con Edison's Construction Environmental Health and Safety (EH&S) Representative must receive a copy of that day's pre-job safety briefing sheet along with the RCIR. Con Edison will look to see that appropriate topics were discussed during that day, as well as noting the person(s) involved in the incident were in attendance for that safety briefing (signatures).

7.6 First Aid and CPR

The PM will verify that GEI field staff has current certifications in first aid and Cardiopulmonary Resuscitation (CPR), so that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association. GEI employees also attend annual Bloodborne Pathogens training in compliance with OSHA regulations.

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8. Medical Surveillance Program

GEI maintains a continuous, corporate, medical surveillance program that includes a plan designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. Steven Hawkins is GEI's CHSO and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at branch office locations. Comprehensive examinations are given to GEI field personnel on an annual or biennial basis (as determined to be appropriate by the CHSO) participating in hazardous waste operations. The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Under the CHSO's supervision, field personnel undergo a complete initial physical examination, including a detailed medical and occupational history, before they participate in hazardous waste site investigations. Extensive annual/biennial reexaminations are also performed. Upon completion of these tests, personnel are certified by an occupational health physician as to whether they are fit for field work in general, and fit to use respiratory protection.

If a GEI employee or other project worker shows symptoms of exposure to a hazardous substance and wishes to be rechecked, he/she will be directed to the nearest area hospital or medical facility.

GEI subcontractor personnel that will enter any active waste handling or other active non-"clean" area must certify that they are participating in a medical surveillance program that complies with OSHA regulations for hazardous waste operations (i.e., 29 CFR 1910.120 and 29 CFR 1926.65). Proof of medical clearance will be submitted to the GEI PM or SSO prior to the start of field activities.

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9. Monitoring

Air monitoring will be performed to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of worker protection needed on-site in the event that intrusive work is conducted. Work requiring air monitoring includes the installation and/or abandonment of monitoring wells, DNAPL recovery wells, oxygen injection wells, and soil vapor points. Additionally, PID screening of the well head space will be conducted during groundwater sampling activities.

GEI may conduct perimeter air monitoring, and work zone monitoring for on-site GEI employees during intrusive activities only. Activities requiring air monitoring will be conducted in accordance with a pre-approved work plan. GEI will monitor and document daily Site conditions and operations and inform field representatives of results. If Action Levels are exceeded, the SSO will immediately implement Site action(s) according to Table 6 below and notify the PM and CHSO.

GEI will provide the following equipment for health and safety monitoring of on-site GEI personnel:

- PID with 10.6 eV lamp or equivalent;
- Drager CMS sampling system and Sensidyne detector tubes and sampling pump
- Particulate Meter (PM-10 capable)
- Four Gas Meter: Lower Explosive Level (LEL) / Oxygen (O_2) / hydrogen sulfide (H_2S) / hydrogen cyanide (HCN) meter;

Air monitoring equipment will be calibrated and maintained in accordance with manufacturer's requirements. Calibrations will be recorded in the project notes daily or on a daily calibration form.

Organic vapor concentrations will be measured using a PID during intrusive activities. During intrusive operations, organic vapor concentrations will be measured continuously. Organic vapor concentrations will be measured upwind of the work site(s) to determine background concentrations at least twice a day, (once in the morning and once in the afternoon). The SSO will interpret monitoring results using professional judgment and according to the alert and Action Limits set forth in the associated Site Work Plan.

A dust meter will be used to measure airborne particulate matter during intrusive activities. Monitoring will be continuous and readings will be averaged over a 15-minute period for comparison with the Action Levels. Monitoring personnel will make a best effort to collect dust monitoring data from downwind of the intrusive activity. If off-site sources are considered to be the source of the measured dust, upwind readings will also be collected.

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A four gas meter will be used to monitor for combustible gases and O_2 content in the work zone during intrusive activities. The meter will also be equipped with an H_2S sensor and an HCN sensor. H_2S monitoring will be completed every 15 minutes or, if a sulfur odor is present, monitoring will be continuous. HCN monitoring will be completed every 15 minutes or, if an almond odor is detected, monitoring will be continuous.

The perimeter and work zone air monitoring will be conducted during demolition activities. Table 6 provides a summary of real time air monitoring Action Levels and contingency plans for work zone activities. The below Action Levels are determined by halving the Permissible Exposure Limits (PELs) or Threshold Limit Values (TLVs) as set forth by OSHA and the American Conference of Government Industrial Hygienists (ACGIH). O_2 values are based on the maximum use limits of a full face respirator if oxygen were being displaced by a chemical.

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Table 6. Real-Time Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level (above background)	Site Action
PID	Work Zone	1.0 ppm	Use Drager CMS for benzene to verify if concentration is benzene. No respiratory protection is required if benzene is not present.
PID	Work Zone	10 ppm	Use Sensidyne detector tube for naphthalene to verify if concentration is naphthalene. No respiratory protection is required if naphthalene is not present.
		10 – 50 ppm	No respiratory protection is required if benzene or naphthalene is not present.
		50 – 100 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels persist, upgrade to Level C.
		> 100 ppm	Stop work, withdraw from work area, notify PM and CHSO.
O_2 Meter	Work Zone	< 20.7%	Stop work, withdraw from work area, ventilate area, notify PM and CHSO.
		> 21.1%	Stop work, withdraw from work area, notify PM and CHSO.
H_2S Meter	Work Zone	< 5.0 ppm	No respiratory protection is required.
		> 5.0 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, notify PM and CHSO.
HCN Meter	Word Zone	< 1.0 ppm	Run CMS Drager tube. Continue monitoring with real-time meter, and continue work if CMS Drager tube reading is less than 2.0 ppm.
		> 1.0 ppm HCN Concentrations < 2.0 ppm	Run CMS Drager tube and confirm concentration is less than 2.0 ppm, notify PM and CHSO. Run CMS tube for sulfur dioxide, hydrogen sulfide, and phosphine chip potential interferences. Continue to monitor with real-time meter.
		> 2.0 ppm	Stop work, and move (with continuous HCN monitoring meter) at lease 25 ppm upwind of the excavation until continuous meter reads less than 1 ppm, notify PM and CHSO. Run CMS Drager hydrogen cyanide chip and re-evaluate activity, continue monitoring with a real-time meter, resume work if concentrations read less than 1.0 ppm.
CGI	Work Zone	< 10% LEL	Investigate possible causes, allow excavation to ventilate, use caution during procedures.
		> 10% LEL	Stop work, allow excavation/borehole to ventilate to < 10% LEL, if ventilation does not result in a decrease to < 10% LEL, withdraw from work area, notify PM and CHSO.
Particulate Meter	Work Zone	150 µg/m^3	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

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10. Site Control Measures

10.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It will include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones will be established on the work site by the Contractor when operations begin for each task requiring such delineation. Maps depicting the zones will be available at the Site.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to Site contaminants exists, will only be allowed access after proper training and medical documentation.

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

Support Zone – The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone.

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

Exclusion Zone – Activities which may involve exposure to Site contaminants, hazardous materials, and/or conditions should be considered an EZ. This zone will be clearly delineated by cones, tapes, or other means. The Contractor may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ will be determined by the Contractor allowing adequate space for the activity to be completed, field members, and emergency equipment.

The Contractor is responsible for constructing, maintaining, and enforcing the zones.

10.2 Buddy System

GEI personnel should be in line-of-site or communication contact with another on-site person. The other on-site person should be aware of his or her role as a “buddy” and be able

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to provide assistance in the event of an emergency. A copy of this plan will be given to any person acting as a GEI "buddy" for informational purposes.

10.3 Sanitation for Temporary Work Sites

Temporary sanitary facilities including toilets will be available on-site.

10.4 Illumination

Illumination requirements identified by OSHA are directed to work efforts inside buildings and/or during non-daylight hours. Activities planned for the Site are anticipated to occur outside during daylight hours. However, if yard areas are used after dark, they will be equipped with illumination that meets or exceeds requirements specified in OSHA Standard 29 CFR 1926.56 "Illumination." Employees will not work on sites that are not properly lighted.

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11. Accident Reporting

11.1 Incident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, chemical spills and property damage. The following steps must be followed when an incident occurs:

1. In life-threatening situations, immediately call 9-1-1.
2. Stop work activity to address any injury, illness, property damage or emergency.
3. Immediately report any incidents to your Supervisor/Project Manager and Regional Health & Safety Officer.
4. If your injury or illness is not life-threatening, call Medcor Triage at 1-800-775-5866 to speak with a medical professional.
5. Complete an Incident Report Form immediately after addressing the incident.

For all vehicle accidents involving another vehicle or damage to property, the employee will take pictures of each vehicle or property involved in the incident and obtain a police report. In some municipalities police will not be dispatched to a non-injury accident, but every effort needs to be made to try and obtain the report.

The Incident Report Form and the Near Miss Reporting Form can be found in Appendix D, on the GEI Health and Safety smartphone app, or on the Health and Safety page of the GEI Intranet. To report subcontractor injuries or incidents, follow the same verbal reporting procedures and submit an email describing the event to the PM and H&S Committee.

The Con Edison Construction Inspector shall be notified immediately of any incidents that occur on the project.

For any incident on Site, all work on the activity where the incident occurred shall cease. GEI will prepare a RCIR / PAP and submit it to Con Edison's Construction EH&S Representative for review/acceptance. Work on the activity where the incident occurred may only resume once Con Edison considers the RCIR / PAP acceptable, at which time it will become an Addendum to the HASP. Work on all other project activities may continue.

Should the incident be an injury or fatality, GEI shall submit, electronically, a completed Con Edison Contractor Injury Report Form within 1 business day of the incident.

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11.1.1 Injury Triage Service

If a GEI employee experiences a work related injury that is not life-threatening, the employee will initiate a call to Medcor Triage at 1-800-775-5866. The injured employee will detail any medical symptoms or complaints which will be evaluated by a Registered Nurse (RN) specially trained to perform telephonic triage. The RN will recommend first aid self-treatment or refer the injured employee for an off-site medical evaluation by a health professional at a clinic within GEI's workers compensation provider network. GEI employees are still required to follow our Accident Reporting procedures as listed above.

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12. Decontamination Procedures

12.1 Personnel Decontamination Station

A personnel decontamination station where employees can drop equipment and remove PPE will be set up at the decontamination pad by the Contractor. It will be equipped with basins for water and detergent, and trash bag(s), or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a sink where they will wash themselves wherever they have potentially been exposed to any contaminants (e.g., hands, face, etc.)

The following specific decontamination procedure will be used as necessary by GEI personnel or subcontractor personnel wearing PPE from Level D through Level C.

- ***Step 1*** **–** Equipment drop (respirator, tools, monitoring equipment, etc.) Decontaminate as appropriate (per GEI's field representative's instructions).
- ***Step 2*** **–** Boot wash/rinse (wash with non-foaming detergent, rinse with fresh water spray). Remove boots. If inner and outer gloves are worn, wash outer gloves, remove and save for later use, or remove and discard outer gloves and place in trash bag/can provided in the decontamination area.
- ***Step 3*** **–** Hard hat removal; wash if visibly contaminated (use same wash as in Step 2).
- ***Step 4*** **–** If Tyvek® (or equivalent) suit was worn and is visibly contaminated, remove and place in trash bag/can provided in the decontamination area or decontaminate (wash) and store for reuse. Contaminated washable coveralls should be removed and bagged for washing.
- ***Step 5*** **–** Respirator and/or eye protection removal (as applicable). Wash (per Step 2) to remove visible contamination.
- ***Step 6*** **–** Remove outer gloves.
- ***Step 7*** **–** Wash potentially exposed skin (use water and soap at indoor sink).
- ***Step 8*** **–** Disinfect respirator per manufacturer's recommendations.

Contaminated PPE (gloves, suits, etc.) will be decontaminated and stored for reuse or placed in plastic bags (or other appropriate containers) and disposed of in an approved facility.

Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with applicable state and federal regulations.

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12.2 Heavy Equipment Decontamination

Modify for the specific project or delete if not applicable (then delete this note).

Heavy equipment decontamination will be performed by the Contractor within the limits of the on-site decontamination pad in accordance with the contract specifications. A steam generator and brushes will be used to clean demolition equipment and other tools. No heavy equipment will be permitted to leave the Site unless it has been thoroughly decontaminated.

Wastewater from the heavy equipment and personnel decontamination areas will be collected and disposed of in accordance with applicable state and federal regulations. The Contractor will be responsible for ultimate disposal of investigation-derived wastes.

12.3 Decontamination Equipment Requirements

The following equipment, if required, should be in sufficient supply to implement decontamination procedures for GEI's equipment.

- Buckets
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handled soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Methanol and/or Nitric Acid
- Liquid detergent and paper towels
- Plastic trash bags

The Contractor performing decontamination procedures is responsible for verifying that the above materials, as required for their operation, are in sufficient supply.

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13. Supplemental Contingency Plan Procedures

13.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their annual health and safety training and new employee health and safety orientation training. Hazardous materials used on the Site will be properly labeled, stored, and handled. SDS will be available to potentially exposed employees. Subcontractors will be required to provide documentation of hazard communication training. GEI will only use Con Edison-approved chemicals on Site. A copy of GEI's Hazard Communication (HAZCOM) Program is provided in Appendix G.

13.2 Fire

In the event of a fire personnel will evacuate the area. GEI's field representative will contact the local fire department with jurisdiction and report the fire. Notification of evacuation will be made to the PM and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM.

13.3 Medical Support

In case of minor injuries, on-site care will be administered with the Site first aid kit. For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger. Notify the PM and the CHSO of the emergency.

Section 1 and Table 1 of this HASP contain detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. In addition, Appendix A includes maps to the hospital and/or occupational health clinic. GEI field personnel will carry a cellular telephone.

13.4 Severe Weather

The contingency plan for severe weather includes reviewing the expected weather to determine if severe weather is in the forecast. Severe weather includes high winds over 30 miles per hour (mph), heavy rains or snow squalls, thunderstorms, tornados, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the Site will be the responsibility of GEI's field representative. Notification of evacuation will be made to the PM and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM. If safe, work can resume 30 minutes after the last clap of thunder or flash of lightening.

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13.5 Spills or Material Release

If a hazardous waste spill or material release occurs, if safe, the SSO or their representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following:

- SDS for the material spilled or released;
- Source of the release or spillage of hazardous material;
- An estimate of the quantity released and the rate at which it is being released;
- The direction in which the spill or air release is moving;
- Personnel who may be or may have been in contact with the material, or air release, and possible injury or sickness as a result;
- Potential for fire and/or explosion resulting from the situation; and
- Estimates of area under influence of release.

If the spill or release is determined to be within the on-site emergency response capabilities, the SSO will verify implementation of the necessary remedial action. If the release is beyond the capabilities of the Site personnel, personnel will be evacuated from the immediate area and the local fire department will be contacted. The SSO will notify the PM and the CHSO.

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

Refueling of sampling equipment will be done with National Fire Protection Association (NFPA)-approved safety cans and by approved United States Coast Guard (USCG) refueling methods. Fuel will be stored in containers meeting applicable fuel storage safety regulations. Refueling of any equipment will take place off Site. Fuel will not be stored on Site. Fuel present on Site will be contained in the fuel tanks of the vehicles or equipment required to perform the work tasks previously described.

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The Emergency Coordinator should take the following steps:

1. Determine the nature, identity and amounts of major spill components;

2. Make sure all unnecessary persons are removed from the spill area;

3. Notify appropriate response teams and authorities;

4. Use proper PPE in consultation with the SSO and information provided on the SDS for the spilled material;

5. If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosive proof equipment to contain or clean up the spill (diesel only vehicles, air operated pumps, etc.);

6. If possible, try to stop the leak with appropriate material;

7. Remove all surrounding materials that can react or compound with the spill; and

8. Notify the Client Project Manager and the Con Edison Construction Representative immediately. Con Edison will make any and all notifications to the various required agencies via Con Edison spill reporting procedures.

13.6 Alcohol and Drug Abuse Prevention

Alcohol and drugs will not be allowed on the work Site. Project personnel under the influence of alcohol or drugs will not be allowed to enter the Site.

13.7 Working Around New York City Trees

No work may occur within the drip line of trees in New York City without a NYCDPR permit. A certified arborist will need to be consulted to determine the need for a permit. This will be coordinated with Con Edison.

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14. Health and Safety Plan Sign-Off

GEI personnel conducting site activities will be familiar with the information in this HASP. After reviewing this plan, please sign the copy in the project files, and bring a copy of the plan with you to the Site.

Site Name: Former Woodworth Avenue Works

Site Activities: Boring Advancement, Sampling Observation, Monitoring Well Installation, Recovery Well Installation, Excavation and Filling, Monitoring Well Repair, Air Monitoring

GEI Project No: 1900674

Print Name/Company	Signature	Date
Project Manager: Melissa Felter, PG		

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Appendix A

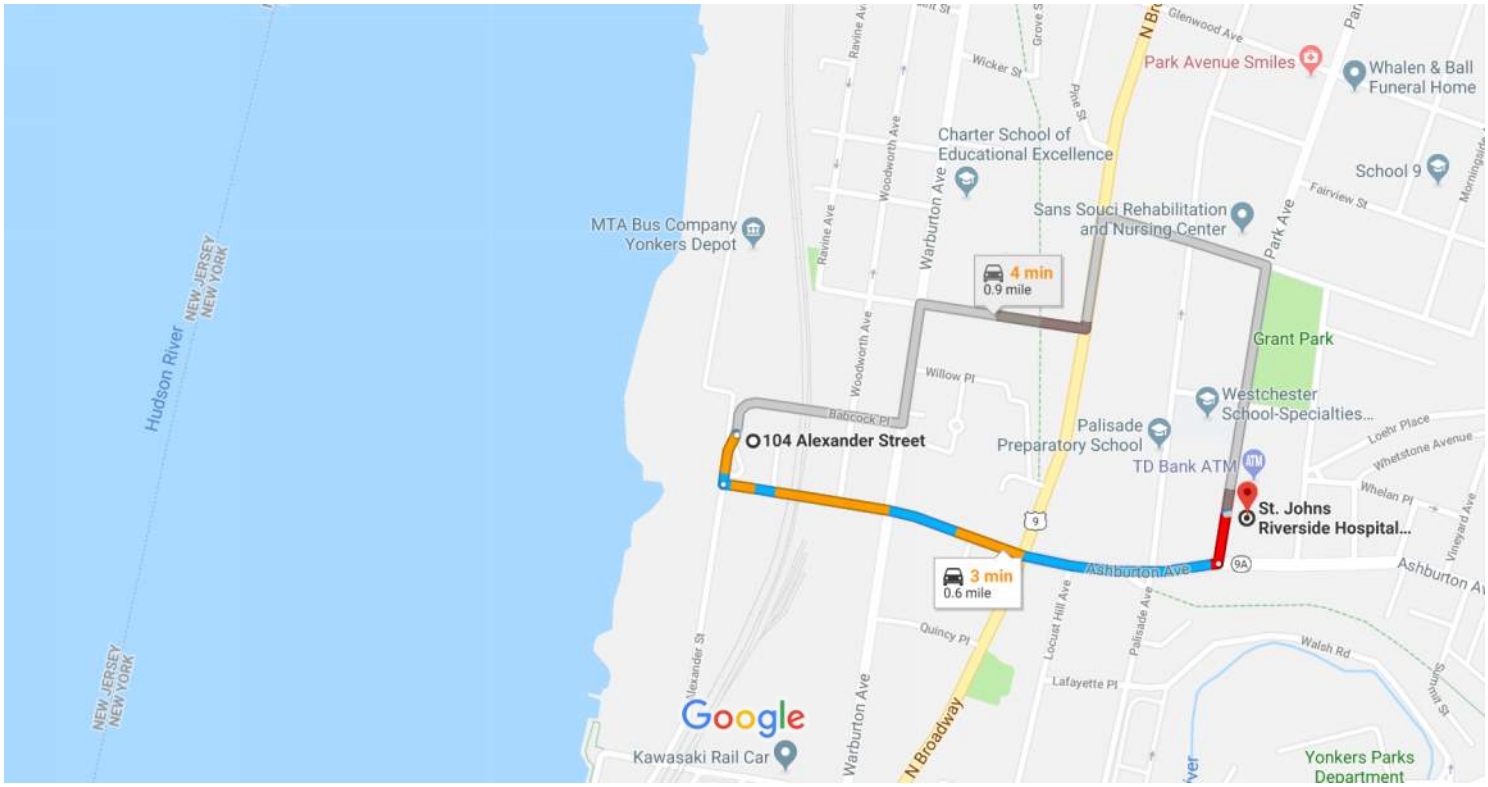
Map to Hospital and Occupational Health Clinic

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Google Maps

104 Alexander Street, Yonkers, NY to St. Johns Riverside Hospital ParkCare Pavilion

Drive 0.6 mile, 3 min



Map data ©2019 Google 500 ft

104 Alexander St

Yonkers, NY 10701

1. Head south on Polychrome Pl toward Ashburton Ave

253 ft

2. Turn left onto Ashburton Ave

0.5 mi

3. Turn left onto Park Ave

Destination will be on the right

240 ft

St. Johns Riverside Hospital ParkCare Pavilion

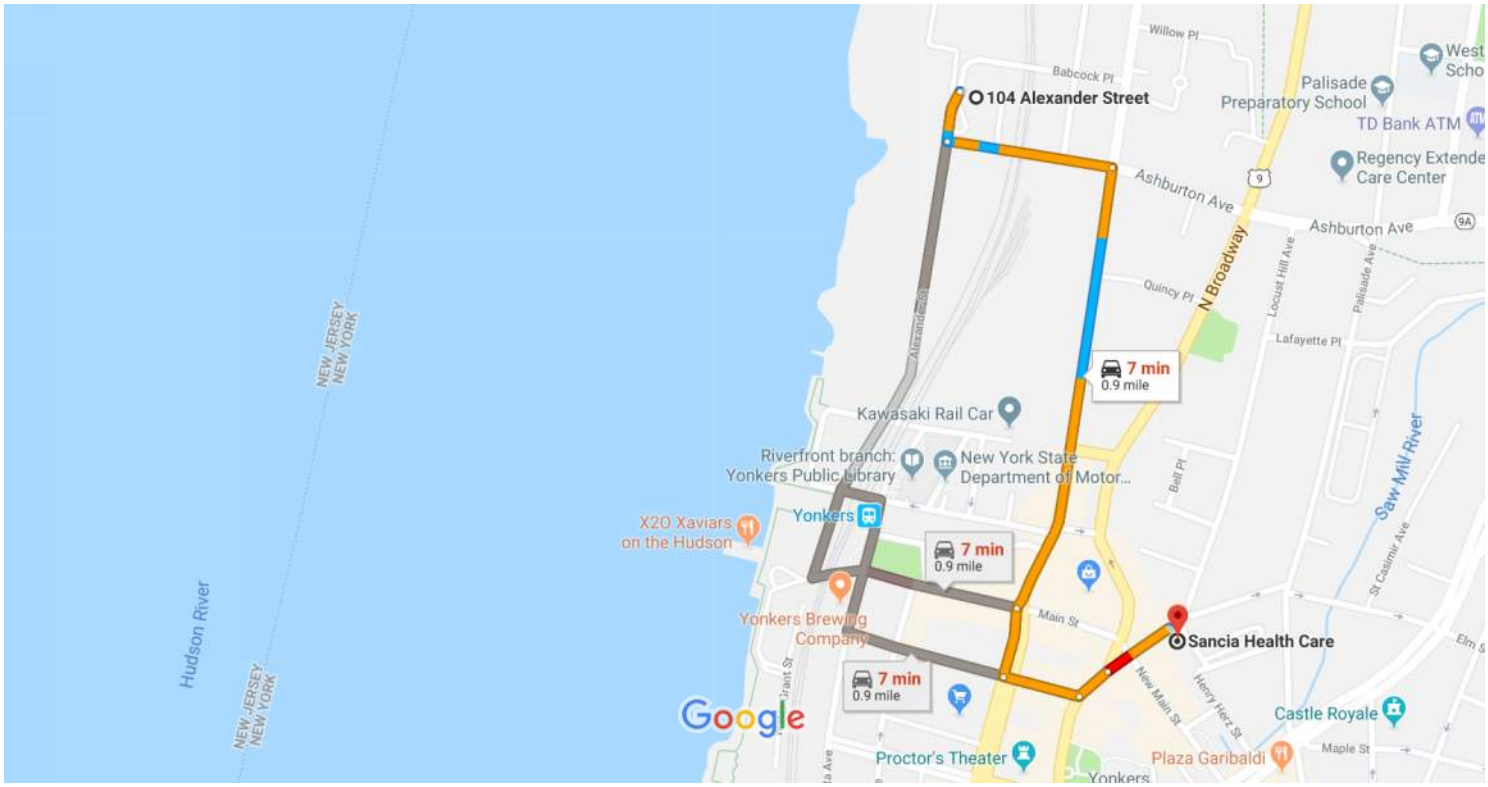
2 Park Ave, Yonkers, NY 10703

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Google Maps

104 Alexander Street, Yonkers, NY to health clinic near 104 alexander st yonkers NY

Drive 0.9 mile, 7 min



Map data ©2019 Google 500 ft

104 Alexander St

Yonkers, NY 10701

1. Head south on Polychrome Pl toward Ashburton Ave

253 ft

2. Turn left onto Ashburton Ave

0.2 mi

3. Turn right onto Warburton Ave

0.4 mi

4. Continue onto New York State Reference Rte 984H/Riverdale Ave

338 ft

5. Turn left onto Hudson St

374 ft

6. Turn left onto S Broadway

184 ft

7. Continue straight onto Palisade Ave

Destination will be on the right

364 ft

Sancia Health Care

10 Palisade Ave, Yonkers, NY 10701

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Appendix B

Safety Data Sheets

Final

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 316
Benzene

Issued: 11/78 Revision: E, 8/90

Section 1. Material Identification

Benzene (C_6H_6) Description: Derived by fractional distillation of coal tar, hydrodealkylation of toluene or pyrolysis of gasoline, catalytic reforming of petroleum, and transalkylation of toluene by disproportionation reaction. Used as a fuel; a chemical reagent; a solvent for a large number of materials such as paints, plastics, rubber, inks, oils, and fats; in manufacturing phenol, ethylbenzene (for styrene monomer), nitrobenzene (for aniline), dodecylbenzene (for detergents), cyclohexane (for nylon), chlorobenzene, diphenyl, benzene hexachloride, maleic anhydride, benzene-sulfonic acid, artificial leather, linoleum, oil cloth, varnishes, and lacquers; for printing and lithography; in dry cleaning; in adhesives and coatings; for extraction and rectification; as a degreasing agent; in the tire industry; and in shoe factories. Benzene has been banned as an ingredient in products intended for household use and is no longer used in pesticides.
Other Designations: CAS No. 0071-43-2, benzol, carbon oil, coal naphtha, cyclohexatriene, mineral naphtha, nitration benzene, phene, phenyl hydride, pyrobenzol.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

R 1
I 4
S 2*
K 4
*Skin absorption

NFPA
3
2 0
-

HMIS
H 3
F 3
R 0
PPG†
† Sec. 8

Cautions: Benzene is a confirmed *human carcinogen* by the IARC. *Chronic low-level exposure may cause cancer (leukemia) and bone marrow damage, with injury to blood-forming tissue.* It is also a dangerous fire hazard when exposed to heat or flame.

Section 2. Ingredients and Occupational Exposure Limits

Benzene, ca 100%*

1989 OSHA PELs
(29 CFR 1910.1000, Table Z-1-A)
8-hr TWA: 1 ppm, 3 mg/m³
15-min STEL: 5 ppm, 15 mg/m³

(29 CFR 1910.1000, Table Z-2)
8-hr TWA: 10 ppm
Acceptable Ceiling Concentration: 25 ppm
Acceptable Maximum Peak: 50 ppm (10 min)†

1989-90 ACGIH
TLV-TWA: 10 ppm, 32 mg/m³

1988 NIOSH RELs
TWA: 0.1 ppm, 0.3 mg/m³
Ceiling: 1 ppm, 3 mg/m³

1985-86 Toxicity Data‡
Man, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted
Man, inhalation, TC_{Lo}: 150 ppm inhaled intermittently over 1 yr in a number of discrete, separate doses affects the blood (other changes) and nutritional and gross metabolism (body temperature increase)
Rabbit, eye: 2 mg administered over 24 hr produces severe irritation

* OSHA 29 CFR 1910.1000, Subpart Z, states that the final benzene standard in 29 CFR 1910.1028 applies to all occupational exposures to benzene except in some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.
† Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift.
‡ See NIOSH, *RTECS* (CY1400000), for additional irritative, mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 176 °F (80 °C)
Melting Point: 42 °F (5.5 °C)
Vapor Pressure: 100 mm Hg at 79 °F (26.1 °C)
Vapor Density (Air = 1): 2.7
Evaporation Rate (Ether = 1): 2.8

Molecular Weight: 78.11
Specific Gravity (15 °C/4 °C): 0.8787
Water Solubility: Slightly (0.180 g/100 g of H_2O at 25 °C)
%Volatile by Volume: 100
Viscosity: 0.6468 mPa at 20 °C

Appearance and Odor: A colorless liquid with a characteristic sweet, aromatic odor. The odor recognition threshold (100% of panel) is approximately 5 ppm (unfatigued) in air. Odor *is not* an adequate warning of hazard.

Section 4. Fire and Explosion Data

Flash Point: 12 °F (-11.1 °C), CC	Autoignition Temperature: 928 °F (498 °C)	LEL: 1.3% v/v	UEL: 7.1% v/v

Extinguishing Media: Use dry chemical, foam, or carbon dioxide to extinguish benzene fires. Water may be ineffective as an extinguishing agent since it can scatter and spread the fire. Use water spray to cool fire-exposed containers, flush spills away from exposures, disperse benzene vapor, and protect personnel attempting to stop an unignited benzene leak.
Unusual Fire or Explosion Hazards: Benzene is a Class 1B flammable liquid. A concentration exceeding 3250 ppm is considered a potential fire explosion hazard. Benzene vapor is heavier than air and can collect in low lying areas or travel to an ignition source and flash back. Explosive and flammable benzene vapor-air mixtures can easily form at room temperature. Eliminate all ignition sources where benzene is used, handled, or stored.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Structural firefighter's protective clothing provides limited protection. Stay out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Runoff to sewer can create pollution, fire, and explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Benzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Benzene explodes on contact with diborane, permanganic acid, bromine pentafluoride, peroxodisulfuric acid, and peroxomonosulfuric acid. It ignites on contact with dioxygen difluoride, dioxygenyl tetrafluoroborate, iodine heptafluoride, and sodium peroxide + water. Benzene forms sensitive, explosive mixture with iodine pentafluoride, ozone, liquid oxygen, silver perchlorate, nitryl perchlorate, nitric acid, and arsenic pentafluoride + potassium methoxide (explodes above 30 °C). A vigorous or incandescent reaction occurs with bromine trifluoride, uranium hexafluoride, and hydrogen + Raney nickel [above 410 °F (210 °C)]. Benzene is incompatible with oxidizing materials.
Conditions to Avoid: Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition of benzene can produce toxic gases and vapors such as carbon monoxide.

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Section 6. Health Hazard Data

Carcinogenicity: The ACGIH, OSHA, and IARC list benzene as, respectively, a supected human carcinogen, a cancer hazard, and, based on sufficient human and animal evidence, a human carcinogen (Group 1).
Summary of Risks: Prolonged skin contact or excessive inhalation of benzene vapor may cause headache, weakness, appetite loss, and fatigue. The most important health hazards are cancer (leukemia) and bone marrow damage with injury to blood-forming tissue from chronic low-level exposure. Higher level exposures may irritate the respiratory tract and cause central nervous system (CNS) depression.
Medical Conditions Aggravated by Long-Term Exposure: Exposure may worsen ailments of the heart, lungs, liver, kidneys, blood, and CNS.
Target Organs: Blood, central nervous system, bone marrow, eyes, upper respiratory tract, and skin.
Primary Entry Routes: Inhalation, skin contact.
Acute Effects: Symptoms of acute overexposure include irritation of the eyes, nose, and respiratory tract, breathlessness, euphoria, nausea, drowsiness, headache, dizziness, and intoxication. Severe exposure may lead to convulsions and unconsciousness. Skin contact may cause a drying rash (dermatitis).
Chronic Effects: Long-term chronic exposure may result in many blood disorders ranging from aplastic anemia (an inability to form blood cells) to leukemia.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Immediately rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air. Emergency personnel should protect against inhalation exposure. Provide CPR to support breathing or circulation as necessary. Keep awake and transport to a medical facility.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* since aspiration may be fatal. Call a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: Evaluate chronic exposure with a CBC, peripheral smear, and reticulocyte count for signs of myelotoxicity. Follow up any early indicators of leukemia with a bone marrow biopsy. Urinary phenol conjugates may be used for biological monitoring of recent exposure. Acute management is primarily supportive for CNS depression.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a benzene spill control and countermeasure plan (SCCP).* Notify safety personnel, evacuate all unnecessary personnel, eliminate all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation, eye contact, and skin absorption. Absorb as much benzene as possible with an inert, noncombustible material. For large spills, dike far ahead of spill and contain liquid. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of confined spaces such as sewers, watersheds, and waterways because of explosion danger. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U019
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1000 lb (454 kg) [* per Clean Water Act, Sec. 307 (a), 311 (b)(4), 112; and per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Tables Z-1-A and Z-2)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: 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 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.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations at least below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and incompatible materials. *Caution! Benzene vapor may form explosive mixtures in air.* To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. When opening or closing benzene containers, use nonsparking tools. Keep fire extinguishers readily available.
Engineering Controls: Because OSHA specifically regulates benzene (29 CFR 1910.1028), educate workers about its potential hazards and dangers. Minimize all possible exposures to carcinogens. If possible, substitute less toxic solvents for benzene; use this material with extreme caution and only if absolutely essential. Avoid vapor inhalation and skin and eye contact. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Designate regulated areas of benzene use (see legend in the box below) and label benzene containers with "DANGER, CONTAINS BENZENE, CANCER HAZARD."
Other Precautions: Provide preplacement and periodic medical examinations with emphasis on a history of blood disease or previous exposure.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Benzene (*benzol*)
DOT Hazard Class: Flammable liquid
ID No.: UN1114
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Benzene
IMO Hazard Class: 3.2
ID No.: UN1114
IMO Label: Flammable liquid
IMDG Packaging Group: II

DANGER
BENZENE
CANCER HAZARD
FLAMMABLE-NO SMOKING
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

MSDS Collection **References:** 1, 2, 12, 26, 73, 84-94, 100, 101, 103, 109, 124, 126, 127, 132, 134, 136, 138, 139, 143
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 409
Cresol (Mixed Isomers)

Issued: 12/78 Revision: B, 3/92

Section 1. Material Identification

Cresol, *mixed isomers* ($CH_3C_6H_4OH$) Description: Derived from coal tar or petroleum. Cresol is marketed by individual isomer and as pure or crude cresol. Pure cresol is a mixture of *ortho*, *meta*, and *para* isomers. Crude cresol (commercial cresol) is prepared by distilling "grey phenic acid" at 356 to 401 °F (180 to 205 °C) and is comprised of 20% *ortho*, 40% *meta*, and 30% *para* isomers, plus small amounts of phenol and xylenols. Each isomer can be prepared synthetically by diazotization of the specific corresponding toluidine. Used in manufacturing synthetic resins, explosives, photographic developers, petroleum, paint, disinfectants, and fumigants; as an ore flotation agent; and in the agriculture industry for herbicides and insecticides.
Other Designations: CAS No. 1319-77-3, Bacillol, cresylic acid, Tekresol, tricresol.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Cresol is severely irritating to mucous membranes, eyes, and skin. Depending on the cresol concentration, extent of exposure, and amount of skin exposed, toxicity may be slight (irritation) or severe (permanent injury or death).

R 1
I 4
S 3*
K 2
* Skin absorption

NFPA
2
3 0
—

HMIS
H 3
F 2
R 0
PPG†
† Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Cresol (*mixed isomers*) National Formulary (NF) grade contains < 5% phenol

1990 OSHA PEL (Skin)
8-hr TWA: 5 ppm (22 mg/m³)

1990 NIOSH REL
TWA: 5 ppm (22 mg/m³)

1990 IDLH Level
250 ppm

1991-92 ACGIH TLV (Skin)
TWA: 5 ppm (22 mg/m³)

1990 DFG (Germany) MAK
TWA: 5 ppm (22 mg/m³) (H)*
Peak Exposure Limit: 10 ppm, 5 min, momentary value/8 per shift

1985-86 Toxicity Data†
Rat, oral, LD_{50}: 1454 mg/kg; toxic effects not yet reviewed
Mouse, inhalation, LC_{50}: 179 mg/m³/2 hr; no toxic effects noted (*o*-)
Rabbit, eye: 103 mg produced severe irritation (*p*-)
Rabbit, skin: 517 mg applied for 24 hr produced severe irritation (*m*-)
Rabbit, skin, LD_{50}: 2000 mg/kg; toxic effects not yet reviewed

* Danger of cutaneous absorption.
† See NIOSH, *RTECS* (GO5950000), for additional toxicity data. For data on specific isomers, see *RTECS* (GO6125000, *meta*; GO6300000, *ortho*; and GO6475000, *para*).

Section 3. Physical Data

Boiling Point Range: 375.8 to 397.4 °F (191 to 203 °C)
Melting Point Range: 51.8 to 95 °F (11 to 35 °C)
Vapor Pressure: 0.25 (*ortho*), 0.15 (*meta*), 0.11 (*para*) mm Hg at 68 °F (20 °C)
Vapor Density (air = 1): 3.72
pH: Saturated solutions are neutral or slightly acidic to litmus
Viscosity: 4.49 to 7.0 cP at 104 °F (40 °C)
Molecular Weight: 108.13
Specific Gravity: 1.030 to 1.038 at 77 °F (25 °C)
Water Solubility: Soluble, 1%
Other Solubilities: Soluble in alcohol, ether, dilute alkalies, glycol and vegetable oils
Refraction Index: 1. 5353 at 75.2 °F (24 °C)
Odor Threshold: Low, 0.012 mg/m³; high, 22 mg/m³

Appearance and Odor: Colorless, yellow, or pinkish liquid turning brown on exposure to air or light with a phenolic odor and pungent taste.

Section 4. Fire and Explosion Data

Flash Point: 178 °F (81.11 °C, *ortho*), 187 °F (86.11 °C, *meta* and *para*), CC	**Autoignition Temperature:** 1110 °F (559 °C, *ortho*), 1038 °F (558 °C, *meta* and *para*)	**LEL:** 1.4% (*ortho*), 1.1% (*meta* and *para*) at 302 °F (150 °C)	**UEL:** None reported

Extinguishing Media: While cresol does not ignite easily, it burns. For small fires, use dry chemical, carbon dioxide (CO_2), water spray, or regular foam. For large fires, use water spray, fog, or regular foam. Do not scatter material with more water than is necessary to put out fire.
Unusual Fire or Explosion Hazards: Container may explode in heat of fire.
Special Fire-fighting Procedures: Since 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 ineffective for fires involving cresol. Use clothing the manufacturer recommends specifically for use with cresol. If possible without risk, remove container from fire area. Fight fire from maximum distance. Stay away from ends of tanks. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Cresol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Cresol reacts with oxidizing materials and causes a temperature and pressure increase with chlorosulfonic acid, nitric acid, and oleum.
Conditions to Avoid: Ignition sources and contact with incompatibles.
Hazardous Products of Decomposition: Thermal oxidative decomposition of cresol can produce carbon dioxide (CO_2) and toxic cresol fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(142) and OSHA(164) do not list cresol as a carcinogen. **Summary of Risks:** Cresol is corrosive to eyes, skin, and mucous membranes. Degree of toxicity depends on the cresol concentration involved, amount of surface area exposed, and duration of exposure. Ingestion is corrosive to the digestive tract's mucous membranes and can pose serious problems if not treated promptly. Because cresol has a low vapor pressure, it is not volatile enough under normal conditions to present an inhalation hazard. If heated, vapor inhalation is likely. Severe chemical burns and dermatitis are the main hazards in industry. Note that cresol's *ortho* and *para* isomers (if used individually) are in crystal form and thus are a dust inhalation hazard. By all routes of exposure, cresol produces toxic symptoms similar to phenol's. **Medical Conditions Aggravated by Long-Term Exposure:** Skin diseases. **Primary Entry Routes:** Skin and eye contact/absorption. **Acute Effects: Target Organs:** Eyes, skin, central nervous system (CNS), liver and kidney. Cresol is absorbed through skin, open wounds, and the mucous membranes of the respiratory and digestive tracts. The rate at which skin absorbs cresol depends more on the size of exposure area than on the concentration of material applied. Cresol is corrosive to the skin causing smarting; tingling; redness; swelling; burns that may be very painful and become white and wrinkled with softening that may become gangrenous; blisters; possible shock as a result

Continue on next page

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Section 6. Health Hazard Data, *continued*

of pain; and, in severe cases of absorption, coma and death. Contact with eyes may cause stinging, and burning, watering of eyes, redness and swelling of lids, corneal opaqueness causing blurred vision and possible loss of sight. In rare cases, a pigment disorder called ochronosis occurs characterized by darkening of skin, conjunctiva, and cartilage of the nose and ears. Ingestion leads to burning of lips, mouth, and throat, pain in swallowing, ulceration of the mucous membranes of the mouth, color change of the tongue (white), thirst, throat swelling, cramps, nausea and vomiting (sometimes of coffee grounds-like material due to digestive hemorrhage). In severe cases symptoms might progress to shock, convulsions, coma, and death. If vapor inhalation occurs, symptoms include irritation of mucous membranes of nose, eyes, and mouth, watering of eyes, sneezing, coughing, difficulty breathing, headache, nausea, muscle weakness, and possible pulmonary edema. In most cases of exposure, if death occurs, it is usually caused by respiratory failure. **Chronic Effects:** Repeated exposure to cresol may cause digestive disturbances, liver, kidney, spleen and pancreatic damage, and skin eruptions or dermatitis. Some people can become allergic or hypersensitive to cresol.

FIRST AID: *Emergency personnel should protect against contamination.*

Eyes: Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. *Do not* allow victim to rub or keep eyes tightly shut. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing to prevent burns. Rinse with flooding amounts of water for at least 15 min. If clothing is stuck to skin after flushing with water, *do not* remove! Thoroughly wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **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 that *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting with 2 tablespoons of Ipecac (adult dose). After patient vomits, give activated charcoal in 8 oz. of water to drink. **After first aid, get appropriate in-plant, paramedic, or community medical support.**

Note to Physicians: Since effects may be delayed, keep victim under observation. Irrigate eyes and wash skin with a mixture of polyethylene glycol 300 and industrial methylated spirits (PEG 300/IMS, 2:1 by volume). Recommended treatment for ingestion is repeated gastric lavage with large quantities of olive oil.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area (with fixed or portable fan systems for cross-ventilation), deny entry, and stay upwind. Shut off all ignition sources. Spilled liquid can be neutralized with crushed limestone or soda ash. Take up small spills with earth, sand, vermiculite or other absorbent, noncombustible material and place into suitable containers. For large spills, dike far ahead of liquid for later disposal or reclamation. For water spills, you may need to trap cresol at the bottom with sandbag barriers, apply activated charcoal, and then remove trapped material with dredges or lifts. Follow applicable OSHA regulations (29 CFR 1910.120).

Environmental Degradation: When released into the atmosphere, cresol degrades by reacting with photochemically produced hydroxyl radicals during the day (half-life = 8 to 10 hr), and with nitrate radicals at night (half-life = 2 to 5 min). Cresol biodegrades in eutrophic (nutrient-rich) waters.

Ecotoxicity Values: Blue gill, TL_m, 24 mg/L/96 hr (fresh water); shrimp, TL_m, 10 to 100 ppm/48 hr (saltwater).

Soil Absorption/Mobility: Cresol is mobile in soil but biodegradation is probable. Cresols probably leach due to water solubility.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U052*

Listed as a CERCLA Hazardous Substance† (40 CFR 302.4): Reportable Quantity (RQ), 1000 lb (454 kg) [† per RCRA, Sec. 3001 and CWA, Sec. 311(b)(4)]

Listed (*o-cresol only*) as a SARA Extremely Hazardous Substance (40 CFR 355)

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

* When a spent solvent and classified as a hazardous waste from nonspecific sources, cresol has Hazardous Waste No. F004.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles or faceshields to protect against droplets or spray, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Respirator: 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. At 50 to 500 ppm use a full face gas mask. 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 respiratory protection program that includes: training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. Rubber is suggested as a material suitable for protection against cresol.

Ventilation: Provide general and 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.[103]

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment.

Comments: 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.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in properly labelled (with trade name) iron or steel containers in cool, dry, well-ventilated location. Protect from light and keep away from incompatibles (Sec. 5). Outside or detached storage is preferred. To prevent static sparks, electrically ground and bond all equipment used in cresol manufacture, use, and storage.

Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level.

Administrative Controls: Consider preplacement and periodic examinations of exposed workers that emphasize skin, kidney, liver, and respiratory system.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Cresol
DOT Hazard Class: Corrosive material
ID No.: UN2076
DOT Label: Corrosive
DOT Packaging Exceptions: 173.244
DOT Packaging Requirements: 173.245

IMO Shipping Name: Cresols (*o-, m-, p-*)
IMO Hazard Class: 6.1
ID No.: UN2076
IMO Label: Poison
IMDG Packaging Group: II

***MSDS Collection* References:** 26, 38, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 140, 153, 159, 162, 163, 164

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** AC Darlington, MPH, MD; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 385
Ethylbenzene

Issued: 8/78 Revision: B, 9/92

Section 1. Material Identification

Ethylbenzene ($C_6H_5C_2H_5$) Description: Derived by heating benzene and ethylene in presence of aluminum chloride with subsequent distillation, by fractionation directly from the mixed xylene stream in petroleum refining, or dehydrogenation of naphthenes. Used as a solvent, an antiknock agent in gasoline; and as an intermediate in production of synthetic rubber, styrene, cellulose acetate, diethylbenzene, acetophenone, ethyl anthraquinone, propyl oxide, and α-methylbenzol alcohol.
Other Designations: CAS No. 100-41-4, ethylbenzol, EB, phenylethane, NCI-C56393.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

R 1
I 3
S 2*
K 4
* Skin absorption

NFPA



HMIS
H 2†
F 3
R 0
PPE - Sec. 8
† Chronic effects

Cautions: Ethylbenzene is a skin and mucous membrane irritant considered the most irritating of the benzene series. Inhalation causes acute and chronic central nervous system (CNS) effects. It is highly flammable and forms explosive mixtures with air.

Section 2. Ingredients and Occupational Exposure Limits

Ethylbenzene, ca >99.0%. Impurities include ~ 0.1% *meta* & *para* xylene, ~ 0.1% cumene, and ~ 0.1% toluene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m³)
15-min STEL: 125 ppm (545 mg/m³)
Action Level: 50 ppm (217 mg/m³)

1990 IDLH Level
2000 ppm

1990 NIOSH REL
TWA: 100 ppm (435 mg/m³)
STEL: 125 ppm (545 mg/m³)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m³)
STEL: 125 ppm (545 mg/m³)

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m³)
Category 1: local irritants
Peak Exposure Limit: 200 ppm, 5 min momentary value, max of 8/shift
Danger of cutaneous absorption

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 100 ppm/8 hr caused eye effects, sleep, and respiratory changes.
Human, lymphocyte: 1 mmol/L induced sister chromatid exchange.
Rat, oral, LD_{50}: 3500 mg/kg; toxic effects not yet reviewed
Rat (female), inhalation, TC_{Lo}: 1000 ppm/7 hr/day, 5 days/wk, for 3 wk prior to mating and daily for 19 days of gestation produced pups with high incidence of extra ribs.[179]

* See NIOSH, *RTECS* (DA0700000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 277 °F (136 °C)
Melting Point: -139 °F (-95 °C)
Surface Tension: 31.5 dyne/cm
Ionization Potential: 8.76 eV
Viscosity: 0.64 cP at 77 °F (25 °C)
Refraction Index: 1.4959 at 68 °F (20 °C)
Relative Evaporation Rate (ether = 1): 0.0106
Bulk Density: 7.21 lb/Gal at 77 °F (25 °C)
Critical Temperature: 651 °F (343.9 °C)
Critical Pressure: 35.6 atm

Molecular Weight: 106.16
Density: 0.863 at 77 °F (25 °C)
Water Solubility: Slightly, 14 mg/100 mL at 59 °F (15 °C)
Other Solubilities: Miscible in alcohol, ether; soluble in carbon tetrachloride, benzene, sulfur dioxide, and many organic solvents; insoluble in ammonia
Odor Threshold: 2.3 ppm
Vapor Pressure: 7.1 mm Hg at 68 °F (20 °C); 10 mmHg at 78.62 °F (25.9 °C); 100 mm Hg 165.38 °F (74.1 °C)
Saturated Vapor Density (Air = 0.075 lb/ft³ or 1.2 kg/m³): 0.0768 lb/ft³ or 1.2298 kg/m³

Appearance and Odor: Colorless, flammable liquid with a pungent odor.

Section 4. Fire and Explosion Data

Flash Point: 64 °F (18 °C) CC	Autoignition Temperature: 810 °F (432 °C)	LEL: 1.0% v/v	UEL: 6.7% v/v

Extinguishing Media: Class 1B Flammable liquid. For small fires, use dry chemical, carbon dioxide, or 'alcohol-resistant' foam. For large fires, use fog or 'alcohol-resistant' foam. Use water only if other agents are unavailable; EB floats on water and may travel to an ignition source and spread fire. **Unusual Fire or Explosion Hazards:** Burning rate = 5.8 mm/min. Vapors may travel to an ignition source and flash back. Container may explode in heat of fire. EB poses a vapor explosion hazard indoors, outdoors, and in sewers. **Special Fire-fighting Procedures:** 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. Cool container sides with water until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Withdraw immediately if you hear rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Ethylbenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Reacts vigorously with oxidizers.
Conditions to Avoid: Exposure to heat and oxidizers.
Hazardous Products of Decomposition: Thermal oxidative decomposition of EB can produce acrid smoke and irritating fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list EB as a carcinogen. **Summary of Risks:** Occupational exposure to EB alone is rare since it is usually present together with other solvents. EB is irritating to the eyes, skin, and respiratory tract. Vapor inhalation produces varying degrees of CNS effects depending on concentration. The liquid is absorbed through the skin but vapors are not. 56 to 64% of inhaled ethylbenzene is retained and metabolized. Urinary metabolites following exposure to 23 to 85 ppm for 8 hr are mandelic acid (64%), phenylglyoxylic acid (25%), and methylphenylcarbinol/1-phenyl ethanol (5%). Concurrent exposure to xylene and ethylbenzene causes slower excretion of EB metabolites. Based on the rat LD_{50}, one manufacturer gives 3 to 4 oz. as the lethal dose for a 100 lb person.

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Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Skin and CNS diseases and impaired pulmonary function (especially obstructive airway disease). **Target Organs:** Eyes, respiratory system, skin, CNS, blood. **Primary Entry Routes:** Inhalation, skin and eye contact. **Acute Effects:** Vapor inhalation of 200 ppm caused transient eye irritation; 1000 ppm caused eye irritation with profuse watering (tolerance developed rapidly); 2000 ppm caused severe and immediate eye irritation and watering, nasal irritation, chest constriction, and vertigo; 5000 ppm was intolerable and caused eye and nose irritation. Inhalation of high concentrations may cause narcosis, cramps, and death due to respiratory paralysis. Skin exposed to pure ethylbenzene for 10 to 15 min absorbed 22 to 33 mg/cm^2/hr. Immersion of hand in solutions of 112 & 156 mg/L for 1 hr absorbed 118 & 215.7 µg/cm^2/hr, respectively. **Chronic Effects:** Repeated skin contact may cause dryness, scaling, and fissuring. Workers chronically exposed to > 100 ppm complained of fatigue, sleepiness, headache, and mild irritation of the eyes and respiratory tract. Repeated vapor inhalation may result in blood disorders, particularly leukopenia (abnormally low level of white blood cells) and lymphocytosis.

FIRST AID

Eyes: *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:** *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. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting! Aspiration of even a small amount of EB in vomitus can cause severe damage since its low viscosity and surface tension will cause it to spread over a large area of the lung tissue.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: BEI = mandelic acid in urine (1.5 g/g of creatinine), sample at end of shift at workweeks end. Since this test is not specific, test for EB in expired air for confirmation.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate and ventilate area, deny entry and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against vapor inhalation and skin/eye contact. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container. Dike far ahead of large spill for later reclamation or disposal. Report any release >1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** If released to soil, EB partially evaporates into the atmosphere, with a half-life of hrs to wks, and some leaches into groundwater, especially in soil with low organic carbon content. Biodegradation occurs with a half-life of 2 days. Some EB may absorb to sediment or bioconcentrate in fish. Evidence points to slow biodegradation in groundwater. In air, it reacts with photochemically produced hydroxyl radicals with a half-life of hrs to 2 days. Additional amounts may be removed by rain. **Ecotoxicity Values:** Shrimp (*Mysidopsis bahia*), LC_{50} = 87.6 mg/L/96 hr; sheepshead minnow (*Cyprinodon variegatus*) LC_{50} = 275 mg/L/96 hr; fathead minnow (*Pimephales promelas*) LC_{50} = 42.3 mg/L/96 hr in hard water & 48.5 mg/L/96 hr in softwater. **Disposal:** A candidate for rotary kiln incineration at 1508 to 2912°F (820 to 1600°C), liquid injection incineration at 1202 to 2912°F (650 to 1600°C), and fluidized bed incineration at 842 to 1796°F (450 to 980°C). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.21): No. D001
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311 (b)(4) & CWA, Sec. 307 (a)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use a powered air-purifying respirator with an appropriate organic vapor cartridge, a supplied-air respirator (SAR), SCBA, or chemical cartridge respirator with appropriate organic vapor cartridge. For < 2000 ppm, use a SAR or 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 respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made of Viton or polyvinylchloride to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean PPE. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in a cool, dry, well-ventilated area away from ignition sources and oxidizers. Outside or detatched storage is preferred. If inside, store in a standard flammable liquids cabinet. Containers should have flame-arrester or pressure-vacuum venting. To prevent static sparks, electrically ground and bond all equipment used with ethylbenzene. Install Class 1, Group D electrical equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain levels as low as possible. Purge and ventilate reaction vessels before workers are allowed to enter for maintenance or cleanup. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, skin, blood, and respiratory system.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Ethylbenzene
DOT Hazard Class: 3
ID No.: UN1175
DOT Packing Group: II
DOT Label: Flammable liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60 L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: —

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 153, 159, 162, 163, 164, 167, 168, 171, 176, 179
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheet Collection

Methanol

MSDS No. 354

Date of Preparation: 11/77 Revision: E, 3/98

Section 1 - Chemical Product and Company Identification 51

Product/Chemical Name: Methanol **Chemical Formula:** CH_4O or CH_3OH **CAS Number:** 67-56-1

Synonyms: carbinol; Coat-B1400; Colonial Spirits; Columbian Spirit; EPA pesticide chemical code 053801; methyl alcohol; methyl hydrate; methyl hydroxide; monohydroxymethane; pyroligneous spirit; pyroxylic spirit; pyroxylic spirits; Surflo-B17; wood alcohol; wood naphtha; wood spirit

Derivation: Prepared by wood pyrolysis; non-catalytic oxidation of hydrocarbons; as a by-product in the fisher-tropsch synthesis; or by reduction of carbon monoxide.

General Use: Used as an industrial solvent; starting material for organic synthesis; antifreeze for windshield washer fluid; in fuel antifreezes; gasoline octane booster; fuel for stoves; extractant for oils; denaturing ethanol; softening agent; food additive; in paint, varnish removers, and embalming fluids; in the manufacture of photographic film, celluloid, textile soap, wood stains, coated fabrics, shatterproof glass, paper coating, waterproofing formulations, artificial leather, dyes.

Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Methanol, ca 100% vol

Trace Impurities (Grade A): Acetone and aldehydes < 30 ppm, acetic acid < 30 ppm

OSHA PELs
8- hr TWA: 200 ppm (260 mg/m^3)
Vacated 1989 Final Rule Limits:
TWA: 200 ppm (260 mg/m^3)
STEL: 250 ppm (325 mg/m^3)

ACGIH TLVs*
TWA: 200 ppm (262 mg/m^3), *Skin*
STEL: 250 ppm (328 mg/m^3)

NIOSH REL
10- hr TWA: 200 ppm (260 mg/m^3), *Skin*
STEL: 250 ppm (325 mg/m^3)

IDLH Level
6000 ppm

DFG (Germany) MAK
TWA: 200 ppm (260 mg/m^3), *Skin*
Category II, 1: Substances with systemic effects; onset of effect ≤ 2 hr; half life < 2 hr
Embryo/Fetus Risk of Damage Classification C†

Peak Exposure Limit:
400 ppm (520 mg/m^3), 30 min, average value. 4/shift

*There are also ACGIH Biological Exposure Indices (BEIs™).

†There is no reason to fear risk of damage to developing embryo or fetus when MAK or BAT values are observed.

Section 3 - Hazards Identification

ANSI Signal Word: Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Methanol is a colorless liquid with a slight alcohol odor when pure, or disagreeably pungent odor when crude. It is irritating to the eyes, skin, and respiratory tract. Exposure may result in headache, visual disturbance, blindness, and respiratory failure. Reproductive effects have been reported in animal testing. This flammable liquid is a moderate explosion hazard. When heated to decomposition, methanol emits carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Wilson Risk Scale	
R	1
I	3
S	2*
K	3

*Skin absorption

HMIS	
H	2*
F	3
R	0
PPE†	

*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption

Target Organs: Eyes, skin, central nervous system (CNS), gastrointestinal (GI) tract, respiratory system

Acute Effects

Inhalation: Irritation, breathing difficulty, headache, drowsiness, vertigo, light-headedness, nausea, vomiting, acidosis (decreased blood alkalinity), visual disturbance, and at high concentrations, CNS damage, convulsions, circulatory collapse, respiratory failure, coma and blindness can result from inhalation of methanol vapor. Concentration ≥ 200 ppm may cause headache; 50,000 ppm can cause death within 1-2 hrs. **Eye:** Contact with liquid may result in irritation, inflamed lids, light sensitization, and superficial lesions. **Skin:** Contact may cause irritation, dermatitis, swelling, scaling, and systemic effects listed under inhalation. **Ingestion:** GI irritation and systemic effects (see Inhalation). Symptoms may be delayed 18-48 hours. Fatal dose: 2-8 ounces.

Carcinogenicity: IARC, NTP, and OSHA do not list methanol as a carcinogen. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Chronic Effects:** Exposure to methanol vapors has caused conjunctivitis, headache, giddiness, insomnia, GI disturbance, impaired vision. CNS damage is also likely. Methanol is slowly eliminated from the body; exposure is considered cumulative over the short term.

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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 for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation develops. **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, then induce vomiting. ***After first aid, get appropriate in-plant, paramedic, or community medical support.*** **Note to Physicians:** Follow emesis with rehydration, correction of acidosis, and folate to enhance formate oxidation. Consider IV administration of ethanol (if blood methanol >20 mg/dL) to show metabolic oxidation of methanol. Assay formic acid in urine, blood pH and plasma bicarbonate.

Section 5 - Fire-Fighting Measures

Flash Point: 54 °F (12 °C) **Flash Point Method:** CC **Burning Rate:** 1.7 mm/min
Autoignition Temperature: 867 °F (464 °C) **LEL:** 6.0% v/v **UEL:** 36% v/v
Flammability Classification: OSHA Class IB Flammable Liquid.

NFPA



Extinguishing Media: Use dry chemical, carbon dioxide, water spray, fog or alcohol-resistant foam. A water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources. **Unusual Fire or Explosion Hazards:** Can form explosive mixtures in the air. The heavier-than-air vapors of methanol may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire. **Hazardous Combustion Products:** Heating methanol to decomposition can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes. **Fire-Fighting Instructions:** *Do not* scatter material with any more water than needed to extinguish fire. *Do not* release runoff from fire control methods to sewers or waterways. **Fire-Fighting Equipment:** 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

Spill /Leak Procedures: Isolate spill area for at least 330-660 feet (100-200 m) in all directions. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. **Small Spills:** Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Use clean non-sparking tools to collect absorbed material. **Large Spills, Containment:** Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. **Cleanup:** Ground all equipment. Use non-sparking tools. **Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers. **Storage Requirements:** Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors. **Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.106) for Class 1B Flammable Liquids.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. **Ventilation:** 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:** Enclose operations and/or provide local explosion-proof exhaust ventilation at the site of chemical release. Where possible, transfer methanol from drums or other storage containers to process containers. Minimize sources of ignition in surrounding areas. **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 concentrations ≤ 2000 ppm, use a supplied air respirator; ≤ 5000 ppm, supplied air (SA) respirator in continuous flow mode; ≤ 6000 ppm, SA respirator with tight-fitting face mask operated in continuous flow mode, or SCBA with full facepiece, or SA respirator with full facepiece; > IDLH/unknown/emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or SA respirator with full facepiece operated in pressure-demand

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or other positive-pressure mode in combination with auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For escape, use an appropriate escape-type 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. **Protective Clothing/Equipment:** Wear chemically protective gloves, boots, aprons, and gauntlets of butyl rubber, Teflon™, Viton™, Saranex™, 4H™, Responder™, Trellchem HPS™, or Tychem 10000™ (Breakthrough Time (BT) >8 hr) to prevent skin contact. Natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl alcohol and CPF 3™ may degrade after contact and are not recommended. Wear splash-proof chemical 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. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, washing facilities available in work area. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. **Comments:** 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.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance and Odor: Colorless; slight alcohol odor when pure, disagreeably pungent odor when crude
Odor Threshold Range: 13.1150 to 26840 mg/m^3
Vapor Pressure: 127 mm Hg at 77 °F (25 °C)
Vapor Density (Air=1): 1.11
Saturated Vapor Density (air=1.2 kg/m^3, 0.075 lb./ft^3): 1.221 kg/m^3
Formula Weight: 32.04
Density: 0.796 g/mL at 59 °F (15 °C)
Specific Gravity (H_2O=1, at 4 °C): 0.81 at 0 °C/4 °C
Bulk Density: 6.59 lbs/gal at 68 F (20 °C)
pH: Slightly acidic
Water Solubility: Miscible
Other Solubilities: Ethanol, acetone, benzene, chloroform, DMSO, ether, ketones, most organic solvents.
Boiling Point: 148 °F (64.7 °C) at 760 mm Hg
Freezing Point: -144.04 °F (-97.8 °C)
Viscosity: 0.614 mPa sec
Refractive Index: 1.3292 at 68 °F (20 °C)/D
Surface Tension: 22.61 dynes/cm
Ionization Potential (eV): 10.84
Henry's Law Constant (H): 4.55 x10^{-6} atm-m^3/mole at 77 °F (25 °C)
Octanol/Water Partition Coefficient: log K_{ow} = -0.77
Soil Sorption Coefficient (log K_{oc}): 0.44

Section 10 - Stability and Reactivity

Stability: Methanol is stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Include beryllium dihydride, metals (potassium, magnesium), oxidants (barium perchlorate, bromine, chlorine, hydrogen peroxide, sodium hypochlorite, phosphorus trioxide), potassium tertbutoxide, carbon tetrachloride and metals, chloroform and heat, diethyl zinc, alkyl aluminum salts, acetyl bromide, chloroform and sodium hydroxide, cyanuric chloride, nitric acid, chromic anhydride, lead perchlorate.
Conditions to Avoid: Vapor inhalation, oxidizers. **Hazardous Decomposition Products:** Thermal oxidative decomposition of methanol can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Section 11- Toxicological Information

Toxicity Data:*

Reproductive Effects:
Rat (female), oral: 7500 mg/kg, administered during gestational days 17-19 produced effects on newborn - behavioral.
Rat (female), oral: 35295 mg/kg administered during gestational days 1-15 produced effects on the fertility index; pre-implantation mortality; and post-implantation mortality.
Rat (female), inhalation: 20000 ppm/7 hr, administered during gestational days 1-22 produced specific developmental abnormalities - musculoskeletal system; cardiovascular (circulatory) system; urogenital system.
Rat (male), oral: 200 ppm/20 hr, 78 weeks prior to mating produced paternal effects - testes, epididymis, sperm duct.
Multiple Dose Toxicity Data:
Rat, oral: 12 g/kg/8 weeks intermittently produced toxic effects: behavioral - ataxia; behavioral - alteration of operant conditioning.
Rat, inhalation: 50 mg/m^3/12 hr/13 weeks intermittently produced degenerative changes to brain and coverings; muscle contraction or spasticity.
Rat, inhalation: 2610 ppm/6 hr/4 weeks intermittently produced toxic effects: endocrine - changes in spleen weight.
Eye Effects:
Rabbit, standard Draize test: 100 mg/24 hr resulted in moderate irritation.

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Section 11- Toxicological Information, continued

Toxicity Data:*

Skin Effects:
Rabbit, standard Draize test: 20 mg/24 hr resulted in moderate irritation.

Acute Oral Effects:
Human, oral, LD_{Lo}: 428 mg/kg produced toxic effects: behavioral - headache; lungs, thorax, or respiration - other changes.
Human, oral, LD_{Lo}: 143 mg/kg produced optic nerve neuropathy, dyspnea, nausea or vomiting.
Rat, oral, LD_{50}: 5628 mg/kg

Acute Dermal Effects:
Monkey, skin, LD_{Lo}: 393 mg/kg
Rabbit, skin, LD_{50}: 15800 mg/kg

Acute Inhalation Effects:
Human, inhalation, TC_{Lo}: 300 ppm produced visual field changes, headache; lungs, thorax, or respiration - other changes.
Rat, inhalation, LC_{50}: 64000 ppm/4 hr

Mutagenicity:
Human, lymphocyte: 300 mmol/L resulted in DNA inhibition.
Rat, oral: 10 µmol/kg resulted in DNA damage.

* See NIOSH, *RTECS* (PC1400000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Trout, LC_{50}: 8,000 mg/L/48 hr; *Pimephales promelas* (fathead minnow) LC_{50}: 29.4 g/L/96 hr.

Environmental Fate: Bioconcentration (BCF, estimated at 0.2) is not expected to be significant. Physical removal from air can occur via rainfall. Relatively rapid evaporation from dry surfaces is likely to occur.

Environmental Degradation: If released to the atmosphere, it degrades via reaction with photochemically produced hydroxyl radicals with an approximate half-life of 17.8 days. If released to water or soil, biodegradation is expected to occur.

Soil Adsorption/Mobility: A low Koc indicates little sorption and high mobility in the soil column.

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 Transportation Data (49 CFR 172.101):

Shipping Name: Methanol
Shipping Symbols: D
Hazard Class: 3
ID No.: UN1230
Packing Group: II
Label: FLAMMABLE LIQUID
Special Provisions (172.102): T*

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 1 L
b) Cargo Aircraft Only: 60 L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: 40

Section 15 - Regulatory Information

EPA Regulations:
Listed and Classified as a RCRA Hazardous Waste (40 CFR 261.33): Characteristic of Ignitability
RCRA Hazardous Waste Number: U154
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) specific per (3) CAA, Sec. 112; (4) RCRA, Sec. 3001
CERCLA Final Reportable Quantity (RQ), 5000 lb (2268 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 1, 73, 99, 103, 124, 136, 149, 176, 190, 209, 216, 217, 218, 222, 223, 224, 227, 228, 230
Prepared By..... HM Spliethoff, MS
Industrial Hygiene Review..... PA Roy, MPH, CIH
Medical Review..... T Thoburn, MD, MPH

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Material Safety Data Sheet Collection

Naphthalene

MSDS No. 624

Date of Preparation: 11/87 Revision: A, 9/97

Section 1 - Chemical Product and Company Identification 50

Product/Chemical Name: Naphthalene
Chemical Formula: $C_{10}H_8$
CAS Number: 91-20-3
Synonyms: Albocarbon; camphor tar; Dezodorator; Mighty 150; moth balls; moth flakes; naftalen (Polish); naphthalin; naphthaline; naphthalinum; naphthene; NTM; 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.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Naphthalene, 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 PELs	ACGIH TLVs	NIOSH RELs	IDLH Level
8-hr TWA: 10 ppm (50 mg/m^3); *Vacated 1989 Final Rule Limit:* 15-min. STEL: 15 ppm (79 mg/m^3)	TWA: 10 ppm (52 mg/m^3) STEL: 15 ppm (79 mg/m^3)	10-hr TWA: 10 ppm (50 mg/m^3); 15-min. STEL: 15 ppm (75 mg/m^3)	500 ppm

DFG (Germany) MAK
10 ppm (50 mg/m^3)

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Naphthalene is a white crystalline solid with a 'moth ball' or coal-tar odor. It is toxic by ingestion. Irritating to skin, eyes, and respiratory system. Naphthalene is a combustible solid. Dust may form explosive mixtures in air if subjected to an ignition source.

Wilson Risk Scale	
R	1
I	3
S	2*
K	2

*Skin absorption

HMIS	
H	2†
F	2
R	0
PPE‡	

†Chronic Effects
‡Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, skin absorption, skin and/or eye contact
Target Organs: Blood (red blood cell effects), eyes, skin, central nervous system (CNS), liver and kidneys
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: IARC, NTP, and OSHA do not list naphthalene as a carcinogen. EPA-D, Not Classifiable as to Human Carcinogenicity; MAK-B, Justifiably suspected of having carcinogenic potential; TLV-A4, Not Classifiable as a Human Carcinogen.
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.
Other: There are two reports of naphthalene crossing the placenta in humans.

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Section 4 - First Aid Measures

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 rests, 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



Flash Point: 174 °F (79 °C); 190 °F (88 °C)

Flash Point Method: OC; CC

Burning Rate: Data not found.

Autoignition Temperature: 979 °F (526 °C)

LEL: 0.9% v/v

UEL: 5.9% v/v

Flammability Classification: Combustible solid

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.

Unusual Fire or Explosion Hazards: Volatile solid that gives off flammable vapors when heated. Dust may explode in air if an ignition source is provided.

Hazardous Combustion Products: Toxic vapors including carbon monoxide.

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.

Fire-Fighting Equipment: 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 (see Sec. 8). Structural clothing is permeable, remain clear of smoke, water fall out, and water run off.

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. 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 (see Sec. 8).

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

Containment: 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.

Storage Requirements: 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.

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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.

Ventilation: 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.

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.

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.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove naphthalene from your shoes and clean personal protective equipment.

Comments: 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.

Section 9 - Physical and Chemical Properties

Physical State: Crystalline solid

Appearance and Odor: White, volatile flakes, cakes, cubes, spheres, or powder; strong coal-tar or moth ball odor

Odor Threshold: 0.084 ppm to 0.3 ppm

Vapor Pressure: 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)

Saturated Vapor Concentration: 100 ppm at 77 °F (25 °C) (approx.)

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

Boiling Point: 424 °F (218 °C)

Melting Point: 176 °F (80.2 °C)

Volatility: Volatilizes appreciably at room temperature; volatile with steam

Octanol/Water Partition Coefficient: log K_{ow} = 3.30

Section 10 - Stability and Reactivity

Stability: Naphthalene is stable at room temperature in closed containers under normal storage and handling conditions. It volatilizes at room temperature.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include aluminum chloride, benzoyl chloride, chromic acid, chromium trioxide, oxidizers. Explosive reaction with dinitrogen pentaoxide. Melted naphthalene will attack some forms of plastics.

Conditions to Avoid: Exposure to heat and ignition sources, incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of naphthalene can produce toxic fumes including carbon monoxide.

Section 11- Toxicological Information

Toxicity Data:*

Acute Effects:

Human (child), oral, LD_{Lo}: 100 mg/kg

Man, unreported, LD_{Lo}: 74 mg/kg

Rat, oral, LD_{50}: 490 mg/kg

Reproductive Effects:

Rat, oral: 4500 mg/kg administered on gestational days 6-15 produced fetotoxicity and other developmental abnormalities.

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Section 11- Toxicological Information, *continued*

Toxicity Data:*

Acute Effects: *continued*
Mouse, oral, LD_{50}: 533 mg/kg
Rat, inhalation, LC_{50}: >340 mg/m^3 produced lacrimation and somnolence.
Genetic Effects:
Hamster, ovary: 15 mg/L induced sister chromatid exchange.
Tumorigenicity:
Mouse, inhalation: 30 ppm/6 hr/2 yr administered intermittently produced toxic effects: tumorigenic - neoplastic by RTECS criteria; lungs, thorax, or respiration - tumors.
Skin Effects:
Rabbit, skin, open Draize test: 495 mg produced mild irritation.
Eye Effects:
Rabbit, eye, standard Draize test: 100 mg produced mild irritation.

*See *NIOSH RTECS* (QJ0525000) for additional toxicity data.

Section 12 - Ecological Information

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.
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.

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.
Container Cleaning and Disposal: Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Naphthalene, crude or Naphthalene, refined
Shipping Symbols: Not listed
Hazard Class: 4.1
ID No.: UN1334
Packing Group: III
Label: FLAMMABLE SOLID
Special Provisions (172.102): A1

Packaging Authorizations
a) Exceptions: 173.151
b) Non-bulk Packaging: 173.213
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 25 kg
b) Cargo Aircraft Only: 100 kg

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: Not listed

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste (40 CFR 261.33). Hazardous Waste Number: U165
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) specific per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307(a); CAA, Sec. 112
CERCLA Final Reportable Quantity (RQ), 100 lb (45.4 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): Not listed

Section 16 - Other Information

References: 73, 99, 103, 124, 139, 140, 167, 168, 179, 190, 196, 197, 200, 220 PC-W6

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Material Safety Data Sheets Collection:

Sheet No. 355
Phenol

Issued: 9/80 Revision: C, 11/90

Section 1. Material Identification

33

Phenol (C_6H_5OH) Description: One of many aromatic compounds in coal tar. Made by alkylating benzene with propylene then oxidizing the resulting cumene to produce phenol and acetone. Used as a feedstock in manufacturing various phenolic resins, caprolactum, bis-phenol-A, and other chemicals and drugs; a disinfectant; a fuel-oil sludge inhibitor; a reagent in chemical analysis; in producing or manufacturing a large variety of aromatic compounds including fertilizers, illuminating gas, coke, explosives, lampblack, paints, paint removers, asbestos goods, wood preservatives, textiles, perfumes, bakelite, rubber, and other plastics; in medical and industrial organic compounds and dyes; and in germicidal paints and slimicides. Phenol has been identified in cigarette smoke and automobile exhaust.
Other Designations: CAS No. 0108-95-2, carbolic acid, hydroxybenzene, monohydroxy benzene, oxybenzene, phenic acid, phenyl alcohol, phenyl hydroxide.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R 1
I 4
S 3*
K 2
* Skin absorption

NFPA
2
3 0
-

HMIS
H 3
F 2
R 0
PPG†
† Sec. 8

Cautions: Phenol has a marked corrosive effect on any tissue. Eye contact may cause severe damage and *blindness*. Its primary entry route is through *skin absorption*. Systemic absorption may cause *liver and kidney damage, convulsions (seizures), or death.*

Section 2. Ingredients and Occupational Exposure Limits

Phenol, ca 100%

1989 OSHA PEL (Skin)
8-hr TWA: 5 ppm, 19 mg/m³

1990-91 ACGIH TLV (Skin)
TWA: 5 ppm, 19 mg/m³

1988 NIOSH REL
TWA: 5 ppm, 19 mg/m³
Ceiling: 15.6 ppm, 60 mg/m³

1985-86 Toxicity Data*
Mammal, inhalation, LC_{50}: 74 mg/m³
Rat, oral, LD_{50}: 317 mg/kg; toxic effects include behavorial changes (convulsions or effect on seizure threshold)
Rabbit, eye, TC_{Lo}: 5 mg produces severe irritation

1987 IDLH Level
250 ppm

* See NIOSH, *RTECS* (SJ3325000), for additional irritative, mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 359.15 °F (181.75 °C) at 760 mm Hg
Melting Point: 109.4 °F (43 °C)
Vapor Pressure: 0.3513 mm Hg at 77 °F (25 °C)
Vapor Density (Air = 1): 3.24
pH: 6 (aqueous solution)
Molecular Weight: 94.11
Specific Gravity (20 °C/4 °C): 1.0576
Water Solubility: 1 g dissolves in about 15 ml H_2O
Viscosity: 12.7 centipoise at 64.9 °F (18.3 °C)

Appearance and Odor: White crystalline solid with a characteristic sharp medicinal sweet, tangy odor detectable above 0.05 ppm. Phenol turns pink or red if it contains impurities or is exposed to heat or light.

Section 4. Fire and Explosion Data

Flash Point: 175 °F (79 °C), CC	Autoignition Temperature: 1319 °F (715 °C)	LEL: 1.7% v/v	UEL: 8.6% v/v

Extinguishing Media: Use water spray, carbon dioxide, dry chemical, or alcohol-type foam to extinguish fires involving phenol. Do not use a solid stream of water since the stream scatters and spreads fire. Use water spray to cool fire-exposed tanks/containers.
Unusual Fire or Explosion Hazards: Phenol presents a moderate fire hazard when exposed to heat, flame, or oxidizers. When heated, it emits toxic fumes and vapors that form explosive mixtures with air. Air mixtures containing 3 to 10% phenol are explosive. Solid phenol burns with difficulty, giving off heavy smoke.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. Be aware of runoff from fire control methods. Water containing phenol can cause severe chemical burns. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Phenol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: In general, phenol is incompatible with strong oxidizing agents and halogens. It coagulates colodion and proteins. A potentially explosive reaction occurs with formaldehyde, peroxydisulfuric acid, peroxymonosulfuric acid, sodium nitrite + heat, and aluminum chloride + nitromethane (at 110 °C/100 bar). A violent reaction occurs with butadiene, sodium nitrite + trifluoroacetic acid, and aluminum chloride + nitrobenzene at 248 °F (120 °C). Combining phenol with mineral oxidizing acids results in fire; with acetaldehyde results in violent condensation; with isocyanates results in heat generation and violent polymerization, with calcium hypochlorite results in an exothermic reaction producing toxic fumes which may ignite; and with nitrides results in heat and flammable gas generation. Hot phenol is corrosive to many metals, including aluminum, lead, magnesium, and zinc. Reaction with these materials causes phenol to discolor.
Conditions to Avoid: Avoid heating phenol above 122 °F (90 °C).
Hazardous Products of Decomposition: Thermal oxidative decomposition of phenol can produce oxides of carbon and water.

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list phenol as a carcinogen. Although no specific evidence of human cancer exists, its carcinogenicity to mice emphasizes the need for precaution when handling this material. Phenol also causes human mutations (genetic changes).
Summary of Risks: Phenol is a general protoplasmic poison that is corrosive to any living tissue it contacts. Toxicity most likely results from dermal (skin) contact or ingestion. Skin absorption occurs readily with a rapid onset of symptoms or death (within 30 min to several hours). Contact with eyes may cause severe damage and blindness. Ingestion of 1 g may be fatal. Although phenol is irritating to the respiratory tract, due to its low volatility and good warning properties, inhalation is typically less of a concern. Chronic toxic effects are uncommon, but may include digestive disturbances, neurological disorders, skin rash (dermatitis), and liver and kidney damage.
Medical Conditions Aggravated by Long-Term Exposure: Individuals with chronic respiratory disorders, pre-existing skin disorders, convulsive disorders, or kidney or liver abnormalities may be at increased risk from phenol exposure.
Target Organs: Liver, kidneys, nervous system, and skin.
Primary Entry Routes: Skin absorption, eye contact, ingestion, and inhalation.
Acute Effects: Skin contact results in white, wrinkled discoloration, followed by a severe burn or systemic poisoning if removed improperly.

Continue on next page

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Section 6. Health Hazard Data, *continued*

Phenol ingestion can cause gangrene and corrosion of lips, mouth, throat, esophagus, and stomach if not properly decontaminated (see First Aid). Although not immediately painful, skin contact can cause serious burns and systemic toxicity. In addition to skin burns and respiratory tract irritation, systemic absorption may cause pallor, anorexia (appetite loss), nausea, vomiting, diarrhea, weakness, muscle aches, darkened urine, headache, tinnitus (ringing in ears), sweating, convulsions, cyanosis (bluish coloration of lips and/or fingertips), shock, unconsciousness, respiratory failure, and death. After ingestion, major percutaneous (skin), or inhalation exposures, collapse and death can be rapid. Ingestion can cause severe tissue corrosion or gangrene affecting lips, mouth, throat, esophagus, and stomach. Eye contact can cause severe corrosive damage to the eye (conjunctival edema, corneal opacification, and hypesthesia) and possible blindness.

Chronic Effects: Chronic phenol poisoning is rarely reported. Symptoms include vomiting, difficulty swallowing, diarrhea, appetite loss, headache, fainting, dizziness, darkened urine, and mental disturbances. Chronic exposure can cause death from liver and kidney damage. Repeated skin contact with phenol or phenol-bearing products can result in dermatitis with dark pigmentation (ochronosis) of skin and whites of eyes (sclerae).

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician immediately.

Skin: Speedy action is critical. Flood exposed area with water and quickly remove contaminated clothing. *As soon as possible*, repeatedly spray or swab with the decontaminating agent polyethyleneglycol-300 (PEG). Immerse extremities in PEG. Rescue personnel should protect themselves from skin contact with phenol. Do not use greases, powders, or ointments to treat phenol burns. *Never* delay phenol removal if PEG is not readily available. Use soap and water instead.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: *Speed is essential in the treatment of oral poisoning.* Immediately consult a physician and poison center. Never give anything by mouth to an unconscious or convulsing person. Administer to that *conscious* person 15 to 30 cc castor oil or another vegetable oil, and be prepared to induce vomiting upon a physician's advice. Vegetable oils slow phenol absorption and reduce local damage.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat ingestion with gastric lavage using 40% aqueous Bacto-Peptone, milk, or water until phenolic odor is eliminated. Then give 15 to 50 cc castor or vegetable oil. Debride necrotic skin. Monitor vital signs, fluid status, electrolytes, BUN, renal and hepatic function, and electrocardiogram. Manage sedation, seizures, renal failure, and fluid electrolyte imbalances symptomatically as indicated.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and skin and eye contact with a self-contained breathing apparatus and full personal protective clothing and equipment. Absorb small spills with some noncombustible inert material and place in a closed metal container for disposal. Dike large spills and allow material to cool and solidify. Using nonsparking tools, shovel solid into steel containers for disposal. Thoroughly flush spill area with water, use caustic soda solution for neutralization, and collect flushings and wash water for disposal. Do not allow phenol to enter sewers, watersheds, or waterways. Follow applicable OSHA regulations (29 CFR 1910.120). Notify proper authorities including the National Response Center (800-424-8802).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4), Sec. 307(a), and per RCRA, Sec. 3001]

Listed as a SARA Extremely Hazardous Substance (40 CFR 355): RQ, 1000 lb; Threshold Planning Quantity (TPQ), 500/10,000 lb

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: 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. Where potential exists for exposures near or over 19 mg/m³, use a MSHA/NIOSH-approved full facepiece respirator with an organic vapor cartridge/canister and dust/mist prefilter. Increased protection is obtained from full facepiece powered-air purifying respirators. 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.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. ACGIH recommends neoprene or butyl rubber as good-to-excellent protective materials.

Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heated surfaces, open flame, and ignition sources. Outside or detached storage is preferred. Protect containers from physical damage.

Engineering Controls: Enclose all operations, eliminating all possible phenol exposure routes. Educate workers about phenol's hazards and potential dangers. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Provide local exhaust ventilation at the site of chemical release. Practice good personal hygiene and housekeeping procedures.

Medical Surveillance: Provide preplacement or periodic medical examinations that emphasize central nervous system (CNS), hepatic, renal, and skin. Tests should include BUN, creatinine, LFTs, and urinalysis. Phenol can be detected in urine in free or conjugated forms. The ACGIH biological exposure index (BEI) is 250 mg total phenol/g creatinine or 15 mg/hr.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Phenol
DOT Hazard Class: Poison B
ID No.: UN1671
DOT Label: Poison
DOT Packaging Exceptions: 173.364
DOT Packaging Requirements: 173.369

IMO Shipping Name: Phenol
IMO Hazard Class: 6.1
ID No.: UN1671
IMO Label: Poison
IMDG Packaging Group: II

MSDS Collection **References:** 1, 2-12, 15, 19, 23, 24, 26, 31, 34, 37, 38, 59, 73, 79, 84, 85, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138-140, 143, 146, 148, 149

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Material Safety Data Sheets Collection:
Sheet No. 351
Styrene *monomer*
Issued: 8/79 Revision: D, 6/92

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Section 1. Material Identification

Styrene *monomer* ($C_6H_5CHCH_2$) **Description:** Produced by catalytic dehydrogenation of ethylbenzene at 932 to 1292 °F (500 to 700 °C) at 30 mm Hg; catalyst is a mixture of zinc oxide (86%), aluminum, calcium, and magnesium. Available in technical (99.2% pure) and polymer (99.6% pure) grades. Occurs naturally in the sap of styracaceous plants, in pyrolysis and cracking products of petroleum derivatives, in bituminous-coal and shale-oil tars, in rubber latexes, and as a product of organic substance pyrolysis. Used in the manufacture of a wide range of polymers including polystyrene and copolymer elastomers such as butadiene-styrene rubber or acrylonitrile-butadiene-styrene (ABS); in production of plastics and insulators, as a resin modifying additive, dental filling component, chemical reaction intermediate, and in agricultural products.
Other Designations: CAS No. 100-42-5, cinnamene, Diarex HF 77, ethenylbenzene, NCI-C02200, phenylethylene, styrol, styropor, vinylbenzene.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.
Cautions: Styrene is extremely flammable and polymerizes easily. The vapor is irritating to eyes, skin, and respiratory system and the liquid may cause burns. Inhalation of high concentrations can lead to central nervous system (CNS) depression.

R 2
I 3
S 2*
K 3
* Skin absorption

NFPA†



HMIS
H 2
F 3
R 2
PPG‡
‡ Sec. 8

† Rating is for *inhibited* monomer

Section 2. Ingredients and Occupational Exposure Limits

Styrene *monomer*, ca 99.6%, containing inhibitors butylcatechol or hydroquinone

1991 OSHA PELs
8-hr TWA: 50 ppm (215 mg/m³)
15-min STEL: 100 ppm (425 mg/m³)

1990 IDLH Level
5000 ppm

1990 NIOSH RELs
TWA: 50 ppm (215 mg/m³)
STEL: 100 ppm (425 mg/m³)

1991-92 ACGIH TLVs (Skin)
TWA: 50 ppm (213 mg/m³)
STEL: 100 ppm (426 mg/m³)

1990 DFG (Germany) MAKs
Ceiling: 20 ppm (85 mg/m³)
Half-life: < 2 hr
Peak Exposure Limit: 40 ppm, 30 min. average value, 4 per shift

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 20 µg/m³ caused eye effects.
Human, skin: 500 mg (non-standard test, *accident*) caused irritation.
Human, HeLa cell: 28 mmol/L caused unscheduled DNA synthesis.
Rat, oral, LD_{50}: 5000 mg/kg; toxic effects not yet reviewed
Rat, inhalation, LC_{50}: 24 g/m³/ 4 hr produced an antipsychotic effect.

* See NIOSH, *RTECS* (WL3675000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 293 °F (145 °C)
Freezing Point: -23 °F (-31 °C)
Vapor Pressure: 5 mm Hg at 68 °F (20 °C)
Viscosity: 0.751 mPa
Refraction Index: 1.5463 at 68 °F (20 °C)
Odor Threshold Range: 0.15 to 25 ppm
Density: 0.9045 at 25/25 °C
Surface Tension: 32.14 dyne/cm at 66.2 °F (19 °C)
Molecular Weight: 104.2
Saturated Vapor Density (air = 1.2 kg/m³): 1.22 kg/m³ or 0.076 lbs/ft³
Water Solubility: Practically insoluble, 0.3 lbs/100 lbs water; floats on water
Other Solubilities: Soluble in benzene, carbon disulfide, carbon tetrachloride, ethanol, ethyl ether and ketones. Dissolves organic substances and polymers.

Appearance and Odor: Colorless to slightly yellow oily liquid with a sweet, pleasant odor at low levels becoming pungent as levels increase.

Section 4. Fire and Explosion Data

Flash Point: 88 °F (31 °C), CC	Autoignition Temperature: 914 °F (490 °C)	LEL: 1.1% v/v	UEL: 7% v/v

Extinguishing Media: A Class 1C flammable liquid. For small fires, use dry chemical, carbon dioxide (CO_2), or regular foam. For large fires, use fog, or regular foam. Water may be ineffective since styrene tends to float on water; use only when other agents are unavailable.
Unusual Fire or Explosion Hazards: Styrene may accumulate static electricity. Hazardous polymerization can occur causing container to rupture due to heat of fire. Vapors may travel to ignition source and flash back. Styrene poses a vapor explosion hazard indoors, outdoors, and in sewers.
Special Fire-fighting Procedures: 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 provides only limited protection. Use protective clothing specifically recommended by manufacturer. Apply cooling water to container sides until well after fire is out. If possible without risk, remove container from fire area. Stay away from ends of tanks. For massive fire in cargo area use monitor nozzles or unmanned hose holders; if this is impossible, withdraw from area and let fire burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Uninhibited styrene monomer is very unstable and even when inhibited (butylcatechol or hydroquinone) polymerization occurs slowly at room temperature and fast at elevated temperatures or in contact with certain initiators. **Chemical Incompatibilities:** Styrene vapor is explosive when exposed to heat or flame; reacts with oxygen above 104 °F (40 °C) to form a heat-sensitive explosive peroxide. Violent polymerization may be initiated by alkali metal-graphite composites, butyllithium, dibenzoyl peroxide, azoisobutyronitrile or di-*tert*-butyl peroxide. Styrene reacts violently with chlorosulfonic acid, oleum, sulfuric acid, chlorine + iron (II) chloride (above 50 °C) and can react vigorously with oxidizing materials. **Conditions to Avoid:** Exposure to heat and ignition sources, light, and contact with incompatibles. **Hazardous Decomposition Products:** Thermal oxidative decomposition of styrene can produce carbon dioxide, acrid smoke and irritating fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC(164) lists styrene monomer as a carcinogen; Class 2B (possibly carcinogenic, limited human evidence in the absence of sufficient animal data). **Summary of Risks:** Styrene is irritating to the eyes, skin, and respiratory system. It is absorbed through the skin at 9 to 15 mg/m²/hr (hand and forearm). Inhalation of high concentrations can cause CNS depression but styrene's pungent, irritating odor is usually enough to prevent acute toxic exposures. If heavy exposure occurs, styrene can saturate the body in 30-40 minutes, is distributed throughout the organs and is rapidly eliminated (~85% in 24 hr) either in urine (71%) or expired air (10%). Unexcreted styrene accumulates in adipose tissue (subcutaneous connective tissue containing fat cells). Ovulation and menstrual disorders were observed in women exposed to styrene. In one case, CNS effects were observed in infants whose mother was exposed to chemicals such as styrene during pregnancy. In general, pregnant women may be at elevated risk because styrene crosses the placental barrier. **Target Organs:** CNS, eyes, respiratory system, and skin. **Primary Entry Routes:** Inhalation, skin contact/absorption. **Medical Conditions Aggravated by Long-term Exposure:** Possibly, liver, kidney, blood, skin, and CNS disorders.
Acute Effects: Inhalation of concentrations as low as 50 ppm causes irritation of the eyes, and respiratory tract.

Continue on next page

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Section 6. Health Hazard Data, *continued*

Symptoms include watering eyes and nose, chest heaviness or pain, difficulty breathing, coughing, bluish face and lips, wheezing, headache, nausea, vomiting, dizziness, fatigue, diarrhea and risk of pulmonary edema (fluid in lungs). Skin contact is irritating, with itching, inflammation and possible blisters. Splashes to the eyes cause irritation, watering, lid inflammation, chemical corneal burns, and possibly, serious lesions. Cases of ingestion have not been reported but by analogy to animal studies it could cause irritation of the lips, mouth, and throat; painful swallowing, abdominal pain, nausea, vomiting, state of shock, possible convulsions and risk of pulmonary edema. **Chronic Effects:** Repeated exposure has caused "styrene sickness" described by nausea, vomiting, appetite loss, and general weakness. Occupational asthma may occur rarely. Functional disorders of the nervous system, irritation of the upper airways, and blood changes particularly leukopenia (abnormally low number of circulating, nucleated white or colorless blood cells) and lymphocytosis (increased number of lymphocytes which are involved in the immune system) have also been observed. Medical exams revealed toxic hepatitis in workers exposed to ~50 mg/m^3 styrene for over 5 yr. Prolonged exposure to < 50 mg/m^3 caused certain liver function disorders (protein, pigment, glycogen). Peripheral neuropathies were observed in chronically exposed workers. Repeated or prolonged skin exposure may cause dermatitis with rough, dry, fissured skin due to defatting.

FIRST AID Eyes: Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Do *not* allow victim to rub or keep eyes tightly shut. Immediately consult a physician. **Skin:** *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. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not induce vomiting!* Gastric lavage may be indicated if victim is at risk of convulsing but the decision should be carefully weighed since severe esophageal irritation may occur. **Note to Physicians:** For acute exposure, give baseline liver and kidney function tests and obtain urinalysis, CBC, amylase and lipase levels. Monitor arterial blood gases and perform chest X-ray if significant respiratory irritation occurs. Phenylglyoxylic and mandelic acid may be determined in urine.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should protect against inhalation and eye and skin contact. Shut off all ignition sources. Use water spray to cool and disperse vapors (this may not prevent ignition in closed spaces). For small spill, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers. For large spills, dike far ahead of liquid spill for later disposal or reclamation. For spills in water, apply activated carbon at 10 X the spilled amount (at least 10,000 ppm) or use barriers or oil spill booms to limit motion. "Universal" gelling agent injected into spill may aid in solidification. Remove material with suction hoses or mechanical dredges. Follow applicable OSHA regulations (29 CFR 1910.120). Report spills in excess of 1000 lb. **Ecotoxicity Values:** TLm, *Pimephales promelas* (fathead minnow), 53.6 mg/L/48 hr; TLm, *Artemia salina* (brine shrimp), 68 mg/L/24 hr and 52 mg/L/48 hr. **Environmental Degradation:** In water, styrene monomer volatilizes rapidly and may be subjected to biodegradation. It is not expected to hydrolyze. In air, styrene will react rapidly with hydroxyl radicals and ozone with a combined calculated half-life of 2.5 to 9 hr. In soil, styrene will biodegrade and leach to groundwater with low to moderate mobility (depending on soil conditions). **Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations Listed as a RCRA Hazardous Waste (40 CFR 261.21 & 261.23): D001 and D003, Characteristic of ignitability and reactivity
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311(b)(4)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A & Z-2)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH/MSHA-approved respirator. For < 500 ppm, use any supplied air respirator (SAR) or SCBA. For < 1250 ppm, use any SAR operated in a continuous flow mode. For < 5000 ppm, use any SAR with a full facepiece in positive pressure mode. 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 respiratory protection program that includes at least: training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polyvinyl alcohol is recommended as suitable material for PPG. **Ventilation:** Provide general and 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.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Thoroughly decontaminate PPG. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Styrene is corrosive to copper or copper alloy containers. Store in cool (hazardous above 32 °C), dry, well-ventilated area away from incompatibles (Sec. 5). Store small refrigerated amounts in glass containers and large amounts in vented metal tanks in outside or detached storage under an inert blanket (i.e., nitrogen). Install electrical equipment Class 1, Group D. Inhibit styrene during storage to prevent polymerization. Uninhibited vapor may polymerize in vents and cause blockage. To prevent static sparks, electrically ground and bond all equipment used in styrene manufacture, use, storage, transfer, and shipping. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Continuously monitor workplace air levels of styrene. Make sure ducting, piping, and pipe joints are leak tight. Give preference to continuous rather than batch techniques and mechanize manual operations. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, blood, liver, kidney, and skin. Consider precluding pregnant women from styrene exposure.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Styrene monomer, inhibited
DOT Hazard Class: Flammable liquid
ID No.: UN2055
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Styrene monomer, inhibited
IMO Hazard Class: 3.3
ID No.: UN2055
IMO Label: Flammable liquid
IMDG Packaging Group: II

MSDS Collection **References:** 73, 89, 100, 101, 103, 124, 126, 127, 131, 132, 133, 136, 139, 140, 148, 149, 153, 159, 162, 163, 164, 167, 168
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** AC Darlington, MPH, MD

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Material Safety Data Sheets Collection:

Sheet No. 318
Xylene *(Mixed Isomers)*

Issued: 11/80 Revision: E, 9/92 Errata: 12/94

Section 1. Material Identification

Xylene (Mixed Isomers) (C_8H_{10}) Description: The commercial product is a blend of the three isomers [*ortho*-(*o*-), *meta*-(*m*-), *para*-(*p*-)] with the largest proportion being *m*- xylene. Xylene is obtained from coal tar, toluene by transalkylation, and pseudocumene. Used in the manufacture of dyes, resins, paints, varnishes, and other organics; as a general solvent for adhesives, a cleaning agent in microscope technique; as a solvent for Canada balsam microscopy; as a fuel component; in aviation gasoline, protective coatings, sterilizing catgut, hydrogen peroxide, perfumes, insect repellants, pharmaceuticals, and the leather industry; in the production of phthalic anhydride, isophthalic, and terephthalic acids and their dimethyl esters which are used in the manufacture of polyester fibers; and as an indirect food additive as a component of adhesives. Around the home, xylene is found as vehicles in paints, paint removers, degreasing cleaners, lacquers, glues and cements and as solvent/vehicles for pesticides.

Other Designations: CAS No. 1330-20-7 [95-47-6; 108-38-3; 106-42-3 (*o*-, *m*-, *p*-isomers)], dimethylbenzene, methyltoluene, NCI-C55232, Violet 3, xylol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 2
S 2
K 3

NFPA



HMIS
H 2†
F 3
R 0
PPE ‡

† Chronic Effects
‡ Sec. 8

Cautions: Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

Section 2. Ingredients and Occupational Exposure Limits

Xylene (mixed isomers): the commercial product generally contains ~ 40% *m*-xylene; 20% each of *o*-xylene, *p*-xylene, and ethylbenzene; and small quantities of toluene. Unpurified xylene may contain pseudocumene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m^3)
15-min STEL: 150 ppm (655 mg/m^3)

1990 IDLH Level
1000 ppm

1990 NIOSH RELs
TWA: 100 ppm (435 mg/m^3)
STEL: 150 ppm (655 mg/m^3)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m^3)
STEL: 150 ppm (651 mg/m^3)
BEI (Biological Exposure Index): Methylhippuric acids in urine at end of shift: 1.5 g/g creatinine

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m^3)
Category II: Substances with systemic effects
Half-life: < 2 hr
Peak Exposure: 200 ppm, 30 min, average value, 4 peaks per shift

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 200 ppm produced olfaction effects, conjunctiva irritation, and other changes involving the lungs, thorax, or respiration.
Man, inhalation, LC_{Lo}: 10000 ppm/6 hr; toxic effects not yet reviewed.
Human, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted.
Rat, oral, LD_{50}: 4300 mg/kg; toxic effect not yet reviewed.
Rat, inhalation, LC_{50}: 5000 ppm/4 hr; toxic effects not yet reviewed.

* See NIOSH, *RTECS* (XE2100000), for additional toxicity data.

Section 3. Physical Data

Boiling Point Range: 279 to 284 °F (137 to 140 °C)*
Boiling Point: *ortho:* 291 °F (144 °C); *meta:* 281.8 °F (138.8 °C); *para:* 281.3 °F (138.5 °C)
Freezing Point/Melting Point: *ortho:* -13 °F (-25 °C); *meta:* -53.3 °F (- 47.4 °C); *para:* 55 to 57 °F (13 to 14 °C)
Vapor Pressure: 6.72 mm Hg at 70 °F (21 °C)
Saturated Vapor Density (Air = 1.2 kg/m^3): 1.23 kg/m^3, 0.077 lbs/ft^3

Appearance and Odor: Clear, sweet-smelling liquid.

Molecular Weight: 106.16
Specific Gravity: 0.864 at 20 °C/4 °C
Water Solubility: Practically insoluble
Other Solubilities: Miscible with absolute alcohol, ether, and many other organic liquids.
Octanol/Water Partition Coefficient: logKow = 3.12-3.20
Odor Threshold: 1 ppm
Viscosity: <32.6 SUS

* Materials with wider and narrower boiling ranges are commercially available.

Section 4. Fire and Explosion Data

Flash Point: 63 to 77 °F (17 to 25 °C) CC | **Autoignition Temperature:** 982 °F (527 °C) (*m*-) | **LEL:** 1.1 (*m*-, *p*-); 0.9 (*o*-) | **UEL:** 7.0 (*m*-, *p*-); 6.7 (*o*-)

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), water spray or regular foam. For large fires, use water spray, fog or regular foam. Water may be ineffective. Use water spray to cool fire-exposed containers. **Unusual Fire or Explosion Hazards:** Xylene vapors or liquid (which floats on water) may travel to an ignition source and flash back. The heat of fire may cause containers to explode and/or produce irritating or poisonous decomposition products. Xylene may present a vapor explosion hazard indoors, outdoors, or in sewers. Accumulated static electricity may occur from vapor or liquid flow sufficient to cause ignition. **Special Fire-fighting Procedures:** 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 will provide limited protection. If feasible and without risk, move containers from fire area. Otherwise, cool fire-exposed containers until well after fire is extinguished. Stay clear of tank ends. Use unmanned hose holder or monitor nozzles for massive cargo fires. If impossible, withdraw from area and let fire burn. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Xylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Xylene is easily chlorinated, sulfonated, or nitrated. **Chemical Incompatibilities:** Incompatibilities include strong acids and oxidizers and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin). Xylene attacks some forms of plastics, rubber, and coatings. **Conditions to Avoid:** Avoid heat and ignition sources and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of xylene can produce carbon dioxide, carbon monoxide, and various hydrocarbon products.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list xylene as a carcinogen. **Summary of Risks:** Xylene is an eye, mucous membrane, and respiratory tract irritant. Irritation starts at 200 ppm; severe breathing difficulties which may be delayed in onset can occur at high concentrations. It is a central nervous system (CNS) depressant and at high concentrations can cause coma. Kidney and liver damage can occur with xylene exposure. With prolonged or repeated cutaneous exposure, xylene produces a defatting dermatitis. Chronic toxicity is not well defined, but it is less toxic than benzene. Prior to the 1950s, benzene was often found as a contaminant of xylene and the effects attributed to xylene such as blood dyscrasias are questionable. Since the late 1950s, xylenes have been virtually benzene-free and blood dyscrasias have not been associated with xylenes. Chronic exposure to high concentrations of xylene in animal studies have demonstrated mild reversible decrease in red and white cell counts as well as increases in platelet counts.

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Section 6. Health Hazard Data, *continued*

Menstrual irregularity was reported in association with workplace exposure to xylene perhaps due to effects on liver metabolism. Xylene crosses the human placenta, but does not appear to be teratogenic under conditions tested to date. **Medical Conditions Aggravated by Long-Term Exposure:** CNS, respiratory, eye, skin, gastrointestinal (GI) , liver and kidney disorders. **Target Organs:** CNS, eyes, GI tract, liver, kidneys, and skin. **Primary Entry Routes:** Inhalation, skin absorption (slight), eye contact, ingestion. **Acute Effects:** Inhalation of high xylene concentrations may cause dizziness; nausea, vomiting, and abdominal pain; eye, nose, and throat irritation; respiratory tract irritation leading to pulmonary edema (fluid in lung); drowsiness; and unconsciousness. Direct eye contact can result in conjunctivitis and corneal burns. Ingestion may cause a burning sensation in the oropharynx and stomach and transient CNS depression. **Chronic Effects:** Repeated or prolonged skin contact may cause drying and defatting of the skin leading to dermatitis. Repeated eye exposure to high vapor concentrations may cause reversible eye damage, peripheral and central neuropathy, and liver damage. Other symptoms of chronic exposure include headache, fatigue, irritability, chronic bronchitis, and GI disturbances such as nausea, loss of appetite, and gas.

FIRST AID *Emergency personnel should protect against exposure.* **Eyes:** *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:** *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. Carefully dispose of contaminated clothing as it may pose a fire hazard. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. Monitor exposed person for respiratory distress. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, *do not induce vomiting!* If spontaneous vomiting should occur, keep exposed person's head below the hips to prevent aspiration (breathing liquid xylene into the lungs). *Aspiration of a few millimeters of xylene can cause chemical pneumonitis, pulmonary edema, and hemorrhage.* **Note to Physicians:** Hippuric acid or the ether glucuronide of *ortho*-toluic acid may be useful in diagnosis of *meta-*, *para-* and *ortho*-xylene exposure, respectively. Consider gastric lavage if a large quantity of xylene was ingested. Proceed gastric lavage with protection of the airway from aspiration; consider endotracheal intubation with inflated cuff.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and ventilate spill area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If feasible and without undue risk, stop leak. Use appropriate foam to blanket release and suppress vapors. Water spray may reduce vapor, but does not prevent ignition in closed spaces. For small spills, absorb on paper and evaporate in appropriate exhaust hood or absorb with sand or some non-combustible absorbent and place in containers for later disposal. For large spills dike far ahead of liquid to contain. Do not allow xylene to enter a confined space such as sewers or drains. On land, dike to contain or divert to impermeable holding area. Apply water spray to control flammable vapor and remove material with pumps or vacuum equipment. On water, contain material with natural barriers, booms, or weirs; apply universal gelling agent; and use suction hoses to remove spilled material. Report any release in excess of 1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** Little bioconcentration is expected. Biological oxygen demand 5 (after 5 days at 20 °C): 0.64 (no stated isomer). **Ecotoxicity values:** LD_{50}, Goldfish, 13 mg/L/24 hr, conditions of bioassay not specified, no specific isomer. **Environmental Degradation:** In the atmosphere, xylenes degrade by reacting with photochemically produced hydroxyl radicals with a half-life ranging from 1-1.7 hr. in the summer to 10-18 hr in winter or a typical loss of 67-86% per day. Xylenes are resistant to hydrolysis. **Soil Absorption/Mobility:** Xylenes have low to moderate adsorption to soil and when spilled on land, will volatilize and leach into groundwater. **Disposal:** As a hydrocarbon, xylene is a good candidate for controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U239, F003 (spent solvent)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4); per RCRA, Sec. 3001]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** 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 concentrations >1000 ppm, use any chemical cartridge respirator with organic vapor cartridges; any powered, air-purifying respirator with organic vapor cartridges; any supplied-air respirator; or any self-contained breathing apparatus. 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.* **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. With breakthrough times > 8 hr, consider polyvinyl alcohol and fluorocarbon rubber (Viton) as materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean PPE. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in clearly labelled, tightly closed, containers in a cool, well-ventilated place, away from strong oxidizing materials and heat and ignition sources. During transferring operations, electrically ground and bond metal containers. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Use hermetically sealed equipment, transfer xylene in enclosed systems, avoid processes associated with open evaporating surfaces, and provide sources of gas release with enclosures and local exhaust ventilation. Use Class I, Group D electrical equipment. **Administrative Controls:** Establish air and biological monitoring programs and evaluate regularly. Consider preplacement and periodic medical examinations including a complete blood count, a routine urinalysis, and liver function tests. Consider hematologic studies if there is any significant contamination of the solvent with benzene. If feasible, consider the replacement of xylene by less toxic solvents such as petrol (motor fuel) or white spirit. Before carrying out maintenance and repair work, steam and flush all equipment to remove any xylene residues.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Xylenes
DOT Hazard Class: 3
ID No.: UN1307
DOT Packing Group: II
DOT Label: Flammable Liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 173.150
b) Nonbulk Packaging : 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 5L
b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: –

***MSDS Collection* References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 176, 180.
Prepared by: MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 683
Polychlorinated Biphenyls (PCBs)

Issued: 11/88 Revision: A, 9/92

Section 1. Material Identification

Polychlorinated Biphenyls [$C_{12}H_{10-n}Cl_n$ (n=3, 4, 5)] Description: A class of nonpolar chlorinated hydrocarbons with a biphenyl nucleus (two benzene nuclei connected by a single C-C bond) in which any or all of the hydrogen atoms have been replaced by chlorine. Commercial PCBs are mixtures of chlorinated biphenyl isomers with varying degrees of chlorination. Prepared industrially by the chlorination of biphenyl with anhydrous chlorine in the presence of a catalyst such as ferric chloride or iron filings. Except for limited research and development applications, PCBs have not been produced in the US since 1977. When large quantities of PCBs were manufactured in the US, they were marketed under the tradename Aroclor (Monsanto) and were characterized by four digit numbers. The first two digits indicating biphenyls (12), triphenyls (54), or both (25, 44); the last two digits indicating the weight percent of chlorine. PCBs' thermal stability, nonflammability, and high dielectric capability made them very useful in electrical equipment. Formerly used as additives in hydraulic fluids, heat transfer systems, lubricants, cutting oils, printer's ink, fire retardants, asphalt, brake linings, automobile body sealants, plasticizers, adhesives, synthetic rubber, floor tile, wax extenders, dedusting agents, pesticide extenders, and carbonless reproducing paper. PCBs are still used in certain existing electrical capacitors and transformers that require enhanced electrical protection to avoid heating from sustained electric faults.

R 1
I 4
S 3*
K 1
* Skin absorption

NFPA



HMIS
H 2‡
F 1
R 0
PPE†
† Sec. 8
‡ Chronic Effects

Other Designations: CAS No. 1336-36-3, Aroclor, Clophen, Chlorextol, chlorinated biphenyls, chlorinated diphenyl, chlorinated diphenylene, chloro biphenyl, chloro-1,1-biphenyl, Dykanol, Fenclor, Inerteen, Kaneclor, Montar, Noflamol, Phenoclor, Pyralene, Pyranol, Santotherm, Sovol, Therminol FR-1

Cautions: PCBs are potent liver toxins that may be absorbed through skin. Potentially, chronic or delayed toxicity is significant because PCBs accumulate in fatty tissue and may reasonably be anticipated to be carcinogens. PCBs are a bioaccumulative environmental hazard. When burned, decomposition products may be more hazardous than the PCBs.

Section 2. Ingredients and Occupational Exposure Limits

PCBs, contain various levels of polychlorinated dibenzofurans and chlorinated naphthalenes as contaminants

1991 OSHA PELs, Skin
8-hr TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m³
8-hr TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m³

1990 DFG (Germany) MAK, Danger of Cutaneous Absorption
TWA (Chlorodiphenyl, 42% chlorine): 0.1 ppm (1 mg/m³)
Category III: Substances with systemic effects, onset of effect > 2 hr., half-life > shift length (strongly cumulative)
Short-term Level: 1 ppm, 30 min., average value, 1 per shift

TWA (Chlorodiphenyl, 54% chlorine): 0.05 ppm (0.5 mg/m³)
Category III: (see above)
Short-term Level: 0.5 ppm, 30 min., average value, 1 per shift

1985-86 Toxicity Data*
Rat, oral, TD: 1250 mg/kg administered intermittently for 25 weeks produced liver tumors.
Mammal, oral, TD_{Lo}: 325 mg/kg administered to female for 30 days prior to mating and from the 1st to the 36th day of gestation produced effects on newborn (stillbirth; live birth index; viability index).

1990 NIOSH REL
TWA (Chlorodiphenyl, 42% chlorine): 0.001 mg/m³
TWA (Chlorodiphenyl, 54% chlorine): 0.001 mg/m³

1992-93 ACGIH TLVs, Skin *
TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m³
TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m³

* These guidelines offer reasonably good protection against systemic intoxication, but may not guarantee that chloroacne won't occur.
† See NIOSH, *RTECS* (TQ1350000), for additional reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: 644-707 °F (340-375 °C)
Melting Point: 42%: -2.2 °F (-19°C); 54%: 14 °F (-10 °C)
Vapor Pressure: 1 mm Hg at 100 °F (38 °C); 10^{-6} to 10^{-3} mm at 20 °C
Molecular Weight: 188.7 to 398.5

Specific Gravity: 1.3 to 1.8 at 20 °C
Water Solubility: Low solubility (0.007 to 5.9 mg/L)
Other Solubilities: Most common organic solvents, oils, and fats; slightly soluble in glycerol and glycols.

Appearance and Odor: PCBs vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins, depending upon chlorine content.

* Physical and chemical properties vary widely according to degree and to the position of chlorination.

Section 4. Fire and Explosion Data

Flash Point: 286-385 °F (141-196 °C) OC*	Autoignition Temperature: 464 °F (240 °C)	LEL: None reported	UEL: None reported

Extinguishing Media: Use extinguishing media suitable to the surrounding fire. Use dry chemical, foam, carbon dioxide (CO_2), or water spray. Water spray may be ineffective. Use water spray to cool fire-exposed containers or transformers. Do not scatter PCBs with high-pressure water streams. **Unusual Fire or Explosion Hazards:** Combustion products (hydrogen chloride, phosgene, polychlorinated dibenzofurans, and furans) are more hazardous than the PCBs themselves. **Special Fire-fighting Procedures:** 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. Approach fire from upwind to avoid highly toxic decomposition products. Structural firefighter's protective clothing will provide *limited* protection. Do not release runoff from fire control methods to sewers or waterways. Dike for later disposal.

* Flash points shown are a range for various PCBs. Some forms do not have flash points.

Section 5. Reactivity Data

Stability/Polymerization: PCBs are very stable materials but are subject to photodechlorination when exposed to sunlight or UV (spectral region above 290 nanometers). Hazardous polymerization cannot occur. **Chemical Incompatibilities:** PCBs are chemically inert and resistant to oxidation, acids, and bases. **Conditions to Avoid:** Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition [1112-1202 °F (600-650 °C)] of PCBs can produce highly toxic derivatives, including polychlorinated dibenzo-para-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), hydrogen chloride, phosgene and other irritants.

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Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] and NTP[169] list PCBs as an IARC probable carcinogen (overall evaluation is 2A; limited human data; sufficient animal data) and NTP anticipated carcinogen, respectively. **Summary of Risks:** PCBs are potent liver toxins that can be absorbed through unbroken skin in toxic amounts without immediate pain or irritation. PCBs have low acute toxicity, but can accumulate in fatty tissue and severe health effects may develop later. Generally, toxicity increases with a higher chlorine content; PCB-oxides are more toxic. The toxic action on the liver also increases with simultaneous exposure to other liver toxins, e.g. chlorinated solvents, alcohol, and certain drugs. Pathological pregnancies (abnormal pigmentations, abortions, stillbirths, and underweight births) have been associated with increased PCB serum levels in mothers; PCBs can be passed in breast milk. PCBs can affect the reproductive system of adults. **Medical Conditions Aggravated by Long-Term Exposure:** Skin, liver, and respiratory disease. **Target Organs:** Skin, liver, eyes, mucous membranes, and respiratory tract. **Primary Entry Routes:** Inhalation, dermal contact, ingestion. **Acute Effects:** Exposure to PCB vapor or mist is severely irritating to the skin, eyes, nose, throat, and upper respiratory tract. Intense acute exposure to high concentrations may result in eye, lung, and liver injury. Systemic effects include nausea, vomiting, increased blood pressure, fatigue, weight loss, jaundice, edema and abdominal pain. Cognitive, neurobehavior and psychomotor impairment and memory loss have also been seen after acute exposure. **Chronic Effects:** Repeated exposure to PCBs can cause chloroacne; redness, swelling, dryness, thickening and darkening of the skin and nails; swelling and burning of the eyes, and excessive eye discharge; distinctive hair follicles; gastrointestinal disturbances; neurological symptoms including headache, dizziness, depression, nervousness, numbness of the extremities, and joint and muscle pain; liver enlargement; menstrual changes in women; and chronic bronchitis. Cancer, primarily liver, is also a possible result of exposure, but data is inconclusive.

FIRST AID **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Rinsing eyes with medical oil (olive, mineral) initially may remove PCB and halt irritation better than water rinsing alone. 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:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. *Multiple soap and water washings are necessary.* Avoid the use of organic solvents to clean the skin. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** In most cases, accidental PCB ingestion will not be recognized until long after vomiting would be of any value. Never give anything by mouth to an unconscious or convulsing person. Vomiting of the pure substance may cause aspiration. Consult a physician. **Note to Physicians:** Monitor patients for increased hepatic enzymes, chloroacne, and eye, gastrointestinal, and neurologic symptoms listed above. Diagnostic tests include blood levels of PCBs and altered liver enzymes.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, provide adequate ventilation, and isolate hazard area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. For small spills, take up with sand or other noncombustible material and place into containers for later disposal. For larger spills, dike far ahead of spill to contain for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** PCBs have been shown to bio-concentrate significantly in aquatic organisms. **Ecotoxicity:** Bluegill, TLm: 0.278 ppm/96 hr. Mallard Duck, LD_{50}: 2000 ppm. **Environmental Degradation:** In general, the persistence of PCBs increases with an increase degree of chlorination. **Soil Absorption/Mobility:** PCBs are tightly absorbed in soil and generally do not leach significantly in most aqueous soil systems. However, in the presence of organic solvents, PCBs may leach rapidly through the soil. Volatilization of PCBs from soil may be slow, but over time may be significant. **Disposal:** Approved PCB disposal methods include: incineration with scrubbing, high-efficiency boilers, landfills, and EPA-approved alternative disposal methods. Each disposal method has various criteria. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1 lb (0.454 kg) [* per CWA, Sec. 311(b)(4) and 307(a)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** 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. Minimum respiratory protection should include a combination dust-fume-mist and organic vapor cartridge or canister or air-supplied, depending upon the situation. 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:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. Butyl rubber, neoprene, Teflon, and fluorocarbon rubber have break through times greater than 8 hrs. **Ventilation:** Provide general and 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.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Segregate contaminated clothing in such a manner so that there is no direct contact by laundry personnel. Implement quality assurance to ascertain the completeness of the cleaning procedures. Remove this material from your shoes and clean PPE. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in a closed, labelled, container in a ventilated area with appropriate air pollution control equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Inform employees of the adverse health effects associated with PCBs. Limit access to PCB work areas to authorized personnel. Consider preplacement and periodic medical examinations with emphasis on the skin, liver, lung, and reproductive system. Monitor PCB blood levels. Consider possible effects on the fetus. Keep medical records for the entire length of employment and for the following 30 yrs.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Polychlorinated biphenyls
DOT Hazard Class: 9
ID No.: UN2315
DOT Packing Group: II
DOT Label: CLASS 9
Special Provisions (172.102): 9, N81

Packaging Authorizations
a) Exceptions: 173.155
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.241

Quantity Limitations
a) Passenger Aircraft or Railcar: 100 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: 34

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 163, 164, 168, 169, 174, 175, 180
Prepared by: MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy MPH, CIH; **Medical Review:** AC Darlington, MD

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2, 3, 7, 8-Tetrachlorodibenzo-*p*-dioxin (TCDD)

MSDS No. 906 Date of Preparation: 6/94

Section 1 - Chemical Product and Company Identification 44

Product/Chemical Name: 2, 3, 7, 8-Tetrachlorodibenzo-*p*-dioxin (TCDD)
Chemical Formula: $C_{12}H_4Cl_4O_2$
CAS No.: 1746-01-6
Synonyms: dioxin; dioxine; NCI-C03714; tetrachlorodibenzodioxin; 2, 3, 7, 8-tetrachlorodibenzo(b, e)(1, 4)dioxin; 2, 3, 7, 8-tetrachlorodibenzo-1, 4-dioxin; TCDBD; TCDD; 2, 3, 7, 8-TCDD; tetradioxin
Derivation: TCDD is not manufactured, but is formed as a by-product of chlorobenzenes, chlorophenols, and the herbicides 2, 4, 5-trichlorophenoxyacetic acid (2, 4, 5-T) and 2-(2, 4, 5-trichlorophenoxy)propionic acid (Silvex) which are produced from 2, 4, 5-trichlorophenol (TCP). 2, 4, 5-T, commonly known as Agent Orange, was the defoliant used during the Vietnam War. TCP, 2, 4, 5-T and Silvex are no longer commercially produced in the U.S. As a chemical and toxicological standard, TCDD can be prepared by catalytic condensation of potassium 2, 4, 5-trichlorophenate. TCDD has been released to the environment during the incineration of chemical wastes including chlorinated benzenes, chlorophenols, and biphenyl ethers, from the improper disposal of certain chlorinated chemical wastes, in emissions from wood burning in the presence of chlorine, in accidental fires involving transformers containing PCBs, and from the use of the herbicides 2, 4, 5-T and Silvex.
General Use: TCDD is an extremely toxic, unwanted by-product and essentially has no beneficial uses. It may be used as a research chemical. **Vendors:** Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

2, 3, 7, 8-Tetrachlorodibenzo-*p*-dioxin, ca 100 %wt. TCDD normally persists as a contaminant in TCP in variable amounts (0.07-6.2 mg/kg). Consequently, the concentrations of TCDD in different batches of Agent Orange varied greatly with an average concentration of about 2 ppm.

OSHA PEL*
None established

NIOSH REL
Carcinogen, lowest feasible concentration.

DFG (Germany) MAK
None established

ACGIH TLV
None established

* A preliminary occupational exposure limit of 0.2 ng/m^3 (200 pg/m^3) is recommended. It provides an ample margin of safety to prevent chloracne and takes into consideration the chronic effects of animal studies and accidental human exposure. [Leung HW et al; *American Industrial Hygiene Association Journal*, 49 (9): 466-74 b(1988)]

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

TCDD is a colorless, crystalline solid at room temperature. It is highly toxic and a potential human carcinogen. Exposure to TCDD-contaminated materials may cause a severe and disabling acne-like rash that may persist for years (chloracne), metabolic disorders, and nervous system and liver damage. In animals, TCDD causes teratogenesis, tumorigenesis, and immunological dysfunction. Findings in humans are inconclusive, but human toxicology is under continuing investigation. Workers may be exposed to TCDD from residues from prior production or use of 2, 4, 5-T or Silvex, waste materials contaminated by TCDD, or contamination resulting from transformer fires. Take every precaution to avoid any exposure to TCDD.

Wilson Risk Scale	
R	1
I	4
S	4*
K	1

*Skin absorption

HMIS	
H	4†
F	1
R	0

†Chronic Effects
PPE‡
‡Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation (dust),* skin contact, ingestion.
Target Organs: Skin, liver, and nervous system.
Acute Effects
Inhalation: Shortness of breath, headaches, fatigue, severe muscle pains, weakness, and digestive disturbance. Most symptoms develop slowly, over many days.
Eye: Conjunctivitis and chemical burns.
Skin: Chemical burns. In most cases, chloracne appears within 2 to 4 weeks after initial exposure. It consists of blackheads with small, pale-yellow cysts. In severe cases, there may be papules (red spots) or even pustules (pus-filled spots). This acne-like rash appears on the cheekbones under the eyes and behind the ears in very mild cases. With increasing severity, the rest of the face and neck are affected and the outer upper arms, chest, back, abdomen, outer thighs and genitalia may be involved in varying degrees in the worst cases. In the worst cases, lesions may be active 15 or more years after the contact has ceased. Chloracne may also appear after ingestion or inhalation. Skin fragility, hirsutism (excessive growth of hair of normal or abnormal distribution), and photosensitivity may also occur.
Ingestion: Nausea, vomiting, and possible pancreatitis.

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Carcinogenicity: The IARC, NTP, MAK , and NIOSH list TCDD as an IARC-2B (possibly carcinogenic to humans: inadequate evidence of carcinogenicity in humans but there is sufficient evidence of carcinogenicity in experimental animals), an NTP-2 (reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals), an MAK-A2 (unmistakably carcinogenic in animal experimentation only), and a NIOSH-X (carcinogen defined with no further categorization). OSHA does not list TCDD as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure: Skin, liver, nervous and endocrine system disorders.
Chronic Effects: Lack of energy, loss of sex drive, personality and mood changes, numbness, weakness and pain in the legs, liver damage, chloracne, and elevated blood lipids. TCDD increased the incidence of a variety of tumors in animals, but human data is inconclusive. Little is known of the human health effects (if any) as a result of long-term exposures to low concentrations.
Comments: The observed health effects from clinical or epidemiological studies of populations who were occupationally and non-occupationally exposed cannot be solely attributed to TCDD because of the concurrent exposure to 2, 4, 5-T and TCP and to other herbicides as well. There is no report of human exposure to TCDD alone.
* Vapor inhalation is unlikely because TCDD has a low vapor pressure.

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. Flush with water to remove solid particles; follow with a soap and water wash of exposed areas. 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: For an acute exposure, obtain liver function tests, CBC, prothrombin time, serum lipids, and uroporphyrins. EMG may be useful in detecting subclinical neuropathy. Current analytical techniques to detect dioxins in human tissue specimens involve gas chromatography and mass spectrometry. Chloracne may respond to topical retinoic acid, and oral tetracyclines may help secondary pustular follicles. Resistant cases may require dermabrasion or acne surgery. Isotretinoin may be tried.
Special Precautions/Procedures: Emergency personnel should protect against contamination.

Section 5 - Fire-Fighting Measures

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Flash Point: None reported.
Autoignition Temperature: None reported.
LEL: None reported.
UEL: None reported.
Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam extinguisher.
Unusual Fire or Explosion Hazards: None reported.
Hazardous Combustion Products: Toxic fumes of chlorine.
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: 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

Spill /Leak Procedures: Notify safety personnel of spill, evacuate all unnecessary personnel, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against skin and eye contact and dust inhalation.
Small Spills: Carefully collect and place in sealed containers for disposal.
Large Spills
Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.
Cleanup: Avoid generating dust. *Do not* sweep! Provide an organized procedure of containment, collection, and disposal of contaminated solutions and residues generated during cleanup. Provide separate facilities for decontamination of large equipment. Conduct repetitive wash/rinse cycles separately, either by using different locations or by spacing in time.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120). For specific recommendations, contact your Department of Environmental Protection or your regional EPA office.

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution. Take all the necessary precautions to avoid any exposure.
Storage Requirements: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Isolate work areas involving TCDD or TCDD-contaminated materials.

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Ventilation: 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.(103) **Administrative Controls:** Consider preplacement and periodic medical examinations with emphasis on the skin, liver, nervous and endocrine systems. Regularly monitor glassware, bench tops, instruments, and tools with wipe tests (wipe with filter paper and measure amount of TCDD). **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 situations where TCDD contamination is low (e.g., exposure to dust contaminated with low levels of TCDD), wear an air-purifying respirator until the extent and characterization of the exposure can be determined. For materials highly contaminated with TCDD, wear respirators that consist of self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive pressure mode. An alternate method utilizes a combination Type C supplied-air respirator, with full facepiece, operated in a pressure-demand mode and equipped with auxiliary positive pressure self-contained air supply. 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. **Protective Clothing/Equipment:** Consider disposable clothing due to the uncertainty of adequate decontamination. Wear protective clothing consisting of both outer (zippered coverall with attached hood and draw string or elastic sleeves, gloves and closure boots) and inner (cotton overalls, undershirts, undershorts, gloves, and socks) garments. For dust or particulate exposure, wear coveralls of a non-woven fabric such as Tyvek or spun bonded polyethylene. For exposure to liquids, wear coveralls, gloves, and boots made of chemically resistant materials such as Saranax coated Tyvek or butyl, nitrile, or neoprene rubber. 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. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area. **Contaminated Equipment:** Shower and change clothes after potential exposures or at the end of the work day. Separate contaminated work clothes from street clothes. Launder before reuse. Place disposable clothing in marked and approved containers for disposal. Remove this material from your shoes and clean personal protective equipment. To prevent cross-contact, provide segregated decontamination locations with separate, controlled, and well-marked entry/exit routes and locations. **Comments:** 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.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance and Odor: Colorless needles
Water Solubility: 19.3 ng/L
Other Solubilities: *o*-dichlorobenzene (1.4 g/L); chlorobenzene (0.72 g/L); benzene (0.57 g/L); chloroform (0.37 g/L); acetone (0.11 g/L); *n*-octanol (0.05 g/L); methanol (0.01 g/L); lard oil (0.04 g/L)

Vapor Pressure: 7.4×10^{-10} mm Hg at 77 °F (25 °C)
Formula Weight: 322
Melting Point: 581-583 °F (305-306 °C)
Octanol/Water Partition Coefficient: log Kow= 7.02
Henry's Law Constant: 1.62×10^{-5} atm m^3/mole at 25 °C (estimated)

Section 10 - Stability and Reactivity

Stability: TCDD is relatively stable toward heat, acids, and alkalis. It is changed chemically when exposed in isooctane or *n*-octanol to UV light. **Polymerization:** Hazardous polymerization cannot occur. **Chemical Incompatibilities:** None reported. **Conditions to Avoid:** Avoid heat and ignition sources. **Hazardous Decomposition Products:** Thermal oxidative decomposition of TCDD can produce toxic fumes of chlorine. Decomposition begins at 932 °F (500 °C) and complete decomposition occurs within 21 sec at 1472 °F (800 °C).

Section 11- Toxicological Information

Toxicity Data:*

Eye Effects:
Rabbit, eye: 2 mg caused moderate irritation.
Acute Effects:
Human, skin, TD_{Lo}: 107 µg/kg produced dermatitis and allergic reaction.
Mammal, oral, LD_{50}: 4200 ng/kg produced changes of the liver, kidney, ureter, bladder, and spleen.
Rat, oral, LD_{50}: 20 µg/kg
Reproductive Effects:
Monkey, oral, TD_{Lo}: 92 ng/kg (46 weeks prior to mating, on each day during gestation, and for 17 weeks following birth) caused effects on the newborn (behavioral; delayed effects).
Genetic Effects:
Human cell: 100 pmol/L caused unscheduled DNA synthesis.

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Genetic Effects *(continued)*:
Human cell: 10 nmol/L caused DNA inhibition.
Tumorigenic Effects:
Rat, oral: 52 µg/kg/2 yr (intermittent) caused liver and thyroid tumors.
Rat, oral: 27 µg/kg/65 weeks (continuous) caused liver and kidney tumors.
Multiple Dose:
Rat, oral: 6500 ng/kg/13 weeks (intermittent) caused changes in liver and thymus weight and pigmented or nucleated red blood cells.
Mouse, skin: 97 µg/kg/13 weeks (intermittent) caused diffuse hepatitis (hepatocellular necrosis); changes in spleen; and death.
* See NIOSH, *RTECS* (HP3500000), for additional toxicity data.

Section 12 - Ecological Information

Environmental Transport: Bioconcentration will occur in aquatic organisms. Due to TCDD's low solubility in water and lipids as well as its low partition coefficient in lipids, TCDD is not likely to accumulate in as many biological systems as DDT.
Environmental Degradation: When released to the atmosphere, gas-phase TCDD is degraded by reaction with hydroxyl radicals and direct photolysis (half-life =8.3 days). Particulate-phase TCDD may be physically removed from air by wet and dry deposition. TCDD may be transported long distances through the atmosphere with surface water sediments being an ultimate environmental sink of airborne particulates. TCDD will absorb to sediment and limit the overall rate by which TCDD is removed from water. TCDD near the water's surface may experience significant photodegradation. 1.5 yr is the persistence half-life of TCDD in lakes. TCDD is generally resistant to biodegradation. Photodegradation on terrestrial surfaces may be an important transformation process. During warm conditions, volatilization from soil surfaces may be a major removal mechanism. Volatilization of TCDD from dry soil surfaces is likely to be faster than from wet soil surfaces. TCDD that has been mixed into soil depths beneath the upper surface boundary will volatilize extremely slowly. On soil surfaces, persistence half-life of TCDD on soil surfaces varies from less than 1 yr to 3 yr. Half-lives in soil interiors may be as long as 12 yr.
Soil Absorption/Mobility: TCDD is immobile in soil and is not expected to leach. Lateral movement due to surface erosion may occur.

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 Transportation Data (49 CFR 172.101):

Shipping Name: Environmentally hazardous substances, solid, n.o.s.*
Shipping Symbols: —
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9
Special Provisions (172.102): 8, B54, N50

Packaging Authorizations
a) Exceptions: 173.155
b) Non-bulk Packaging: 173.213
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: None
b) Cargo Aircraft Only: None

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: —

* If it is in a quantity, in one package which equals or exceeds the RQ of 1 lb (0.454 kg).

Section 15 - Regulatory Information

EPA Regulations: RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) specific per CWA, Sec. 307(a)
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations: Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): Not listed

Section 16 - Other Information

References: 73, 103, 124, 132, 136, 139, 184, 187, 189, 190, 193
Prepared By MJ Wurth, BS **Industrial Hygiene Review** PA Roy, MPH, CIH **Medical Review** T Thoburn, MD, MPH
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Issued: 8/79 Revision: E, 9/92 Errata: 2/94

Section 1. Material Identification

Toluene ($C_6H_5CH_3$) Description: Derived from petroleum i.e., dehydrogenation of cycloparaffin fractions followed by the aromatization of saturated aromatic hydrocarbons or by fractional distillation of coal-tar light oil and purified by rectification. Used widely as a solvent (replacing benzene in many cases) for oils, resins, adhesives, natural rubber, coal tar, asphalt, pitch, acetyl celluloses, cellulose paints and varnishes; a diluent for photogravure inks, raw material for organic synthesis (benzoyl & benzilidene chlorides, saccharine, TNT, toluene diisocyanate, and many dyestuffs), in aviation and high octane automobile gasoline, as a nonclinical thermometer liquid and suspension solution for navigational instruments.
Other Designations: CAS No. 108-88-3, Methacide, methylbenzene, methylbenzol, phenylmethane, toluol, Tolu-sol.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 3
S 2*
K 3
* Skin absorption

NFPA



HMIS
H 2- Chronic effects
F 3
R 0
PPE-Sec. 8

Cautions: Toluene is an eye, skin, and respiratory tract irritant becoming narcotic at high centrations. Liver and kidney damage has occurred. Pregnant women chronically exposed to toluene have shown teratogenic effects. Toluene is highly flammable.

Section 2. Ingredients and Occupational Exposure Limits

Toluene, < 100%; may contain a small amount of benzene (~ 1%), xylene, and nonaromatic hydrocarbons.

1991 OSHA PELs
8-hr TWA: 100 ppm (375 mg/m³)
15-min STEL: 150 ppm (560 mg/m³)

1990 IDLH Level
2000 ppm

1990 NIOSH RELs
TWA: 100 ppm (375 mg/m³)
STEL: 150 ppm (560 mg/m³)

1992-93 ACGIH TLV (Skin)
TWA: 50 ppm (188 mg/m³)

1990 DFG (Germany) MAK*
TWA: 100 ppm (380 mg/m³)
Half-life: 2 hr to end of shift
Category II: Substances with systemic effects
Peak Exposure Limit: 500 ppm, 30 min average value, 2/shift

1985-86 Toxicity Data†
Man, inhalation, TC_{Lo}: 100 ppm caused hallucinations, and changes in motor activity and changes in psychophysiological tests.
Human, oral, LD_{Lo}: 50 mg/kg; toxic effects not yet reviewed
Human, eye: 300 ppm caused irritation.
Rat, oral, LD_{50}: 5000 mg/kg
Rat, liver: 30 µmol/L caused DNA damage.

* Available information suggests damage to the developing fetus is probable.
†See NIOSH, *RTECS* (XS5250000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 232 °F (110.6 °C)
Melting Point: -139 °F (-95 °C)
Molecular Weight: 92.15
Density: 0.866 at 68 °F (20/4 °C)
Surface Tension: 29 dyne/cm at 68 °F (20 °C)
Viscosity: 0.59 cP at 68 °F (20 °C)
Refraction Index: 1.4967 at 20 °C/D

Water Solubility: Very slightly soluble, 0.6 mg/L at 68 °F (20 °C)
Other Solubilities: Soluble in acetone, alcohol, ether, benzene, chloroform, glacial acetic acid, petroleum ether, and carbon disulfide.
Vapor Pressure: 22 mm Hg at 68 °F (20 °C); 36.7 mm Hg at 86 °F (30 °C)
Saturated Vapor Density (Air = 0.075 lb/ft³ or 1.2 kg/m³): 0.0797 lb/ft³ or 1.2755 kg/m³
Odor Threshold (range of all referenced values): 0.021 to 69 ppm

Appearance and Odor: Colorless liquid with a sickly sweet odor.

Section 4. Fire and Explosion Data

Flash Point: 40 °F (4.4 °C) CC	**Autoignition Temperature:** 896 °F (480 °C)	**LEL:** 1.27% v/v	**UEL:** 7.0% v/v

Extinguishing Media: Toluene is a Class 1B flammable liquid. To fight fire, use dry chemical carbon dioxide, or 'alcohol-resistant' foam. Water spray may be ineffective as toluene floats on water and may actually spread fire. **Unusual Fire or Explosion Hazards:** Concentrated vapors are heavier than air and may travel to an ignition source and flash back. Container may explode in heat of fire. Toluenes' burning rate = 5.7 mm/min and its flame speed = 37 cm/sec. Vapor poses an explosion hazard indoors, outdoors, and in sewers. May accumulate static electricity. **Special Fire-fighting Procedures:** 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 provides only limited protection. Apply cooling water to sides of tanks until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from fire and let burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire because a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Toluene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization can't occur. **Chemical Incompatibilities:** Strong oxidizers, concentrated nitric acid, nitric acid + sulfuric acid, dinitrogen tetroxide, silver perchlorate, bromine trifluoride, tetranitromethane, and 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione. **Conditions to Avoid:** Contact with heat, ignition sources, or incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of toluene can produce carbon dioxide, and acrid, irritating smoke.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list toluene as a carcinogen. **Summary of Risks:** Toluene is irritating to the eyes, nose, and respiratory tract. Inhalation of high concentrations produces a narcotic effect sometimes leading to coma as well as liver and kidney damage. 93% of inhaled toluene is retained in the body of which 80% is metabolized to benzoic acid, then to hippuric acid and excreted in urine. The remainder is metabolized to *o*-cresol and excreted or exhaled unchanged. Toluene metabolism is inhibited by alcohol ingestion and is synergistic with benzene, asphalt fumes, or chlorinated hydrocarbons (i.e. perchloroethylene). Toluene is readily absorbed through the skin at 14 to 23 mg/cm²/hr. Toluene is absorbed quicker during exercise than at rest and appears to be retained longer in obese versus thin victims; presumably due to its lipid solubility. There is inconsistent data on toluene's ability to damage bone marrow; chronic poisoning has resulted in anemia and leucopenia with biopsy showing bone marrow hypo-plasia. These reports are few and some authorities argue that the effects may have been due to benzene contaminants. Chronic inhalation during pregnancy has been associated with teratogenic effects on the fetus including microcephaly, CNS dysfunction, attentional deficits, developmental delay + language impairment, growth retardation, and physical defects including a small midface, short palpebral fissures, with deep-set eyes, low-set ears, flat nasal bridge with a small nose, micrognathia, and blunt fingertips. There is some evidence that toluene causes an autoimmune illness in which the body produces antibodies that cause inflammation of its own kidney.

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Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Alcoholism and CNS, kidney, skin, or liver disease. **Target Organs:** CNS, liver, kidney, skin. **Primary Entry Routes:** Inhalation, skin contact/absorption. **Acute Effects:** Vapor inhalation causes respiratory tract irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, watering eyes, nervousness, insomnia, parasthesis, and vertigo progressing to narcotic coma. Death may result from cardiac arrest due to ventricular fibrillation with catecholamines loss. Liquid splashed in the eye causes conjunctival irritation, transient corneal damage and possible burns. Prolonged skin contact leads to drying and fissured dermatitis. Ingestion causes GI tract irritation and symptoms associated with inhalation. **Chronic Effects:** Symptoms include mucous membrane irritation, headache, vertigo, nausea, appetite loss and alcohol intolerance. Repeated heavy exposure may result in encephalopathies (cerebellar ataxia and cognitive dysfunction), liver enlargement, and kidney dystrophy (wasting away). Symptoms usually appear at workdays end, worsen at weeks end and decrease or disappear over the weekend. **FIRST AID Eyes:** *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 an ophthalmologist immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting because of danger of aspiration into the lungs. Gastric lavage may be indicated if large amounts are swallowed; potential toxicity needs to be weighed against aspiration risk when deciding for or against gastric lavage. **Note to Physicians:** Monitor cardiac function. If indicated, use epinephrine and other catecholamines carefully, because of the possibility of a lowered myocardial threshold to the arrhythmogenic effects of such substances. Obtain CBC, electrolytes, and urinalysis. Monitor arterial blood gases. If toluene has > 0.02% (200 ppm) benzene, evaluate for potential benzene toxicity. BEI: hippuric acid in urine, sample at shift end (2.5 g/g creatinine); Toluene in venous blood, sample at shift end (1.0 mg/L).

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel protect against inhalation and skin/eye contact. Use water spray to cool and disperse vapors but it may not prevent ignition in closed spaces. Cellosolve, hycar absorbent materials, and fluorocarbon water can also be used for vapor suppression/containment. Take up small spill with earth, sand, vermiculite, or other absorbent, noncombustible material. Dike far ahead of large spills for later reclamation or disposal. For water spills, (10 ppm or greater) apply activated carbon at 10X the spilled amount and remove trapped material with suction hoses or use mechanical dredges/lifts to remove immobilized masses of pollutants and precipitates. Toluene can undergo fluidized bed incineration at 842 to 1796 °F (450 to 980 °C), rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C), or liquid injection incineration at 1202 to 2912 °F (650 to 1600 °C). Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Blue gill, LC_{50} = 17 mg/L/24 hr; shrimp (*Crangonfracis coron*), LC_{50} = 4.3 ppm/96 hr; fathead minnow (*Pimephales promelas*), LC_{50} = 36.2 mg/L/96 hr. **Environmental Degradation:** If released to land, toluene evaporates and undergoes microbial degradation. In water, toluene volatilizes and biodegrades with a half-life of days to several weeks. In air, toluene degrades by reaction with photochemically produced hydroxyl radicals. **Disposal:** Treat contaminated water by gravity separation of solids, followed by skimming of surface. Pass through dual media filtration and carbon absorption units (carbon ratio 1 kg to 10 kg soluble material). Return waste water from backwash to gravity separator. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U220
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg)
[* per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307 (a)]
Listed as a SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses with shatter-resistant glass and side-shields or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** 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 < 1000 ppm, use any chemical cartridge respirator with appropriate organic vapor cartridges, any supplied-air respirator (SAR), or SCBA. For < 2000 ppm, use any SAR operated in continuous-flow mode, any SAR or SCBA with a full facepiece, or any air-purifying respirator with a full facepiece having a chin-style, front or back mounted organic vapor canister. 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:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polyvinyl alcohol with a breakthrough time of > 8 hr, Teflon and Viton are recommended as suitable materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove toluene from your shoes and clean PPE. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from ignition sources and incompatibles. Outside or detached storage is preferred. If stored inside, use a standard flammable liquids warehouse, room, or cabinet. To prevent static sparks, electrically ground and bond all equipment used with toluene. Do not use open lights in toluene areas. Install Class 1, Group D electrical equipment. Check that toluene is free of or contains < 1% benzene before use. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Adopt controls for confined spaces (29 CFR 1910.146) if entering areas of unknown toluene levels (holes, wells, storage tanks). Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, liver, kidney, and skin. Include hemocytometric and thrombocyte count in cases where benzene is a contaminant of toluene. Monitor air at regular intervals to ensure effective ventilation.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Toluene
DOT Hazard Class: 3
ID No.: UN1294
DOT Packing Group: II
DOT Label: Flammable Liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 150
b) Non-bulk Packaging: 202
c) Bulk Packaging: 242

Quantity Limitations
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements
Vessel Stowage: B
Other: --

CSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 140, 148, 153, 159, 163, 164, 167, 169, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, CIH, MPH; **Medical Review:** AC Darlington, MD, MPH

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Material Safety Data Sheets Collection:

Sheet No. 7
Nitric Acid

Issued: 10/88 Revision: D, 9/92

Section 1. Material Identification

Nitric Acid (HNO_3) Description: A solution of nitrogen dioxide in water commercially available in many concentrations. Derived by oxidation of ammonia by catalytic process (heated platinum catalyst); or by direct synthesis, combining atmospheric nitrogen and oxygen in an electric arc (an expensive process, thus largely abandoned). HNO_3 is usually found in conjunction with nitrogen dioxide, which is considered more hazardous. Used in fertilizer production (ammonium nitrate), in photoengraving, steel etching, explosives (TNT, nitroglycerin, trinitrophenol); manufacture of metallic nitrates, sulfuric acid, aqua regia and oxalic acid, jewelry, various dyes and dyestuffs, pharmaceuticals; as a laboratory reagant, in metallurgy (*mainly* as a pickling agent) and the printing industy.
Other Designations: CAS No. 7697-37-2, aqua fortis, aqua regia, azotic acid, engravers nitrate, hydrogen nitrate, red fuming nitric acid (RFNA), white fuming nitric acid (WFNA).
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for suppliers list.

Cautions: Nitric acid is a corrosive, strong oxidizer that causes irritation or severe burns to the skin, eyes, and respiratory tract. Exposures to high levels of the concentrated acid can be fatal. Increases the flammability of combustibles. Use extreme caution when handling HNO_3.

	HMIS		NFPA
R 2	H 3*	*Fuming* nitric acid	
I 4	F 0		
S 4	R 1		
K 0	PPE**		
R 2	H 3*	*> 40%* nitric acid	
I 4	F 0		
S 4	R 1		
K 0	PPE**		
R 2	H 3*	*≤ 40%* nitric acid	
I 3	F 0		
S 3	R 0		
K 0	PPE**		

* Chronic effects ** See Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Nitric acid, various %. Commercially available in nearly all concentrations; most common are 56 and 68%. RFNA (85%), WFNA (97.5%).

1991 OSHA PELs
8-hr TWA: 2 ppm (5 mg/m³)
15-min STEL: 4 ppm (10 mg/m³)

1990 IDLH Level
100 ppm

1990 NIOSH REL
8-hr TWA: 2 ppm (5 mg/m³)
15-min STEL: 4 ppm (10 mg/m³)

1992-93 ACGIH TLVs
TWA: 2 ppm (5.2 mg/m³)
STEL: 4 ppm (10 mg/m³)

1990 DFG (Germany) MAK
2 ppm (5 mg/m³)
Category I: local irritants
Peak Exposure Limit: 2 ppm
5 min momentary value, 8 per shift

1985-86 Toxicity Data*
Man, unreported route, LD_{Lo}: 110 mg/kg; toxic effects not yet reviewed
Rat, oral, TD_{Lo}: 5275 g/kg administered from 1 to 21 days of pregnancy caused post-implantation mortality and specific developmental abnormalities of the musculoskeletal system.
Rat, inhalation, LC_{50}: 67 ppm (NO_2)/4 hr; toxic effects not yet reviewed

* See NIOSH, *RTECS* [QU5775000 (nitric acid), QU5900000 (RFNA), QU6000000 (WFNA)] , for additional reproductive and toxicity data.

Section 3. Physical Data

Boiling Point: 186.8 °F (86 °C)
Melting Point: -43.6 °F (-42 °C)
Vapor Pressure: 67% HNO_3 = 6.8 mm Hg at 68 °F (20 °C); 95 to 98% = 113 at 100.4 °F (38 °C)
Saturated Vapor Density (Air = 1.2 kg/m³): 1.212 kg/m³ or 0.0757 lb/ft³ (67 % HNO_3)
pH: 1

Molecular Weight: 63.02
Density: 1.50269 at 77/39.2 °F (25/4 °C)
Water Solubility: Soluble (releases heat)
Ionization Potential: 11.95 eV

Appearance and Odor: Transparent, clear to yellow, fuming liquid with an acrid, suffocating odor which darkens to a brownish color on aging and exposure to light. "Fuming" nitric acid is red-brown in color.

Section 4. Fire and Explosion Data

Flash Point: Noncombustible	Autoignition Temperature: Noncombustible	LEL: None reported	UEL: None reported

Extinguishing Media: For small fires (< 40% HNO_3), use dry chemical, carbon dioxide (CO_2), water spray, or regular foam. For large fires, use water spray, fog, or regular foam. For small fires (> 40% HNO_3), use water spray, dry chemical, or soda ash. For large fires, flood area with water (*do not* get inside HNO_3 containers). Apply water from as far a distance as possible.
Unusual Fire or Explosion Hazards: HNO_3 is noncombustible but is an oxidizer which increases fire involving combustibles and can initiate an explosion. It releases flammable hydrogen gas in contact with many metals.
Special Fire-fighting Procedures: 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 fires involving nitric acid. Acid-resistant clothing is needed. Apply cooling water to sides of containers until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. *Do not* release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Nitric acid decomposes in air and in contact with light and organic matter. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Nitric acid reacts explosively with combustibles, organics or readily oxidizable materials such as wood, turpentine, metal powder and hydrogen sulfide, carbides, cyanides, and alkalies; causes spattering with strong bases; is corrosive to paper, cloth and most metals (except aluminum, gold, platinum, thorium, and tantalum. Will also attack some forms of plastics, rubber, and coatings. There are at least 150 chemicals and chemical combinations which are incompatible with nitric acid. HNO_3 reacts with water to produce heat and toxic corrosive fumes. Refer to *Genium* references 126 and 159 for further detail. **Conditions to Avoid:** Avoid exposure to moisture, heat, and incompatibles.
Hazardous Decomposition Products: Thermal oxidative decomposition of HNO_3 produces nitrogen peroxide and toxic, irritating nitrogen oxides.

Section 6. Health Hazards Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list nitric acid as a carcinogen.
Summary of Risks: Nitric acid is very corrosive to the skin, eyes, digestive and respiratory tract or any tissue it comes in contact with. 58 to 68% (nitric acid) vapors are moderately irritating and can't be tolerated at high concentrations. 95% (nitric acid) vapors cause severe irritation at very low levels and the liquid causes 2nd and 3rd degree burns on short contact with skin or eyes. Vapor inhalation may cause pulmonary edema (fluid in lungs) leading to death. HNO_3 vapor or mist can slowly corrode teeth when chronically exposed. **Medical Conditions Aggravated by Long-Term Exposure:** Chronic respiratory diseases. **Target Organs:** Eyes, skin, respiratory tract, teeth.

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Section 6. Health Hazard Data, continued

Primary Entry Routes: Inhalation, ingestion, skin and eye contact. **Acute Effects:** Inhalation symptoms may take several hours and include throat and nose irritation, cough, chest pain, difficulty breathing, salivation, giddiness, nausea, muscular weakness, ulceration of nasal mucous membranes, pulmonary edema, and chemical pneumonia. Skin contact is moderately irritating to severely corrosive depending on % of nitric acid. Burns may penetrate deeply causing ulcers. Skin may be stained yellowish brown. Dilute solutions cause irritation and tend to harden the epithelium (outer skin layer) without destroying it. HNO_3 liquid causes yellow discoloration of the eyes and severe burns which may result in permanent damage, i.e., sight loss. Ingestion produces immediate pain and digestive tract burns followed by throat swelling, convulsions, risk of stomach perforation (causing a rigid abdomen) and possible coma. **Chronic Effects:** Repeated inhalation of low concentrations may cause chronic bronchitis, tooth erosion, and/or appetite loss. Repeated exposure to $NO_{(x)}$ such as produced by thermal decomposition of HNO_3 is implicated in chronic lung diseases.

FIRST AID

Eyes: *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:** *Quickly* remove contaminated clothing (*do not force removal if stuck to skin*). Rinse with flooding amounts of water for at least 15 min. Apply a 5% triethanolamine solution to affected area. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **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 that *conscious and alert* person drink 1 to 2 glasses of water to dilute followed by lime milk or milk of magnesia. Do not induce vomiting. *Do not* give sodium bicarbonate or attempt to neutralize the acid.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Observe for several hours since symptoms such as pulmonary edema may be delayed.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should wear fully-encapsulating vapor-protective clothing. Use water spray to cool and disperse vapor. Keep combustibles away from spilled material. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in dry containers for disposal. For large spill, flush with water to containment area and neutralize with agricultural (slaked) lime, sodium bicarbonate, crushed limestone, soda ash, or lime. Report any release in excess of 1000 lb. Control runoff and dike for disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a SARA Extremely Hazardous Substance (40 CFR 355), TPQ: 1000 lb

Listed as a RCRA Hazardous Waste (40 CFR 261.22): No. D001, Characteristic of corrosivity

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311(b)(4)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Listed as a Process Safety Hazardous Chemical (29 CFR 1910.119), TQ: 500 lb

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** 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 < 50 ppm, use any supplied-air respirator operated in a continuous-flow mode. For < 100 ppm, use any supplied-air respirator or 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:** Wear acid-proof gloves, boots, aprons, and gauntlets to prevent skin contact. **Ventilation:** Provide general and 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.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in aluminum, stainless steel, or glass containers on a cement floor in a cool, dry, well-ventilated area away from incompatibles (Sec. 5). Dike around storage tanks with large kirbs or stills to retain the acid in event of leakage. Keep neutralization agents on hand and install a fire hydrant in storage area. (See NFPA Code 43A). **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the eyes, skin, respiratory tract and teeth. Pulmonary function tests (FEV< FVC) are helpful. Educate workers about the hazardous properties of nitric acid.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: *, †, ‡, §, ¥, ψ, ϕ

DOT Hazard Class: 8

ID No.: UN1826 (*†), UN1796 (‡§), UN2031 (¥ψ), UN2032 (ϕ)

DOT Packing Group: I (†§¥ϕ), II (*‡ψ)

DOT Packaging Label: Corrosive (*‡¥ψ), Corrosive, Oxidizer (†§), Corrosive, Oxidizer, Poison (ϕ)

Special Provisions (172.102): B2, T12, T27 (*); T12, T27 (†); B2, T12, T27 (‡); T12, T27 (§); B12, B53, T9, T27 (¥); B2, B12, B53, T9, T27(ψ); 2, B9, B32, B74, T38, T43, T45(ϕ)

Packaging Authorizations

a) Exceptions: None

b) Non-bulk Packaging: 173.158 (*†‡§¥ψ), 173.227 (ϕ)

c) Bulk Packaging: 173.242 (*‡ψ), 173.243 (†§¥), 173.244(ϕ)

Quantity limitations

a) Passenger Aircraft or Railcar: Forbidden

b) Cargo Aircraft Only: 30L (*‡ψ), 2.5L (†§¥), Forbidden (ϕ)

Vessel Stowage Requirements

a) Vessel stowage: D

b) Other: 40(*); 40, 66, 89 (†); 40 (‡); 40, 66, 89 (§); 110, 111 (¥); 110, 111 (ψ); 40, 66, 74, 89, 90, 95 (ϕ)

* Nitrating acid mixtures spent, < 50% HNO_3

† Nitrating acid mixtures spent, > 50% HNO_3

‡ Nitrating acid mixtures, < 50% HNO_3

§ Nitrating acid mixtures, > 50% HNO_3

¥ Nitric acid other than red fuming, > 70% HNO_3

ψ Nitric acid other than red fuming, < 70% HNO_3

ϕ Nitric acid, red fuming.

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 136, 139, 140, 148, 149, 153, 159, 162, 163, 164, 167, 168, 171, 174, 175

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheet Collection

Coal Tar Creosote

MSDS No. 757

Date of Preparation: 7/91 Revision: A, 9/97

Section 1 - Chemical Product and Company Identification 50

Product/Chemical Name: Coal tar creosote
Chemical Formula: Not found; consists of many compounds and the composition depends on the coal used to make the tar and the design and operating conditions of the coke oven and still.
CAS Number: 8001-58-9
Synonyms: AWPA #1; brick oil; Caswell No. 225; coal tar oil; creosote; creosote oil; creosote P1; creosotum; cresylic creosote; heavy oil; liquid pitch oil; naphthalene oil; Preserv-o-sote; Sakresote; tar oil; wash oil
Derivation: By distillation of coal tar produced by high-temperature carbonization of bituminous coal; by mixing strained naphthalene oil, wash oil, and strained or light anthracene oil; as a by-product of conventional coal coking.
General Use: Used mainly as a wood preservative for railroad ties, poles, fence posts, marine pilings, and other lumber for outdoor use; as a water-proofing agent, fuel oil constituent, frothing agent for mineral separation, tap hole refractory cement, and lubricant for die molds. Used only in limited quantities as an animal and bird repellent, animal dip, and insecticide (ovicide).
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Coal tar creosote consists of aromatic hydrocarbons, anthracene, naphthalene, and phenanthrene derivatives; some tar acids; and tar bases. Polycylic aromatic hydrocarbons make up at least 75%.* (198)

OSHA PEL†
8-hr TWA: 0.2 mg/m^3

NIOSH REL†
0.1 mg/m^3 (cyclohexane-extractable fraction)
Carcinogen

DFG (Germany) MAK
None established

ACGIH TLV†
TWA: 0.2 mg/m^3

IDLH Level†
80 mg/m^3

* Creosote contains several carcinogenic polycyclic aromatic hydrocarbons including benz[a]anthracene, benzo[a]pyrene, and dibenz[a,h]anthracene.
† Coal tar pitch volatiles, as benzene solubles (CAS No. 65996-93-20)

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Coal tar creosote is a colorless (pure) or yellow to black (industrial) liquid with an aromatic smoky smell. It is irritating to the eyes, skin and respiratory tract and can be corrosive, causing severe burns. Coal tar creosote is a probable human carcinogen. It is a combustible liquid that is a moderate fire hazard when exposed to an ignition source.

Wilson Risk Scale
R 1
I 3
S 3
K 2
* Skin absorption

HMIS
H 3†
F 2
R 0
PPE‡
†Chronic effects
‡Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, skin absorption, and skin and/or eye contact
Target Organs: Eyes, skin, bladder, kidneys, and respiratory system
Acute Effects *Note! Phenol and phenolic derivatives of various aromatic hydrocarbons (tar acids), present in low concentrations, are the constituents most likely to be responsible for acute toxicity.*
Inhalation: Inhalation of vapors causes moderate irritation to the nose, throat, and upper respiratory tract.
Eye: Contact with liquid causes conjunctivitis (inflammation of the eye's lining), keratitis (corneal inflammation), or corneal burns with scarring. May cause loss of vision.
Skin: Contact causes irritation, burning, itching, redness, pigment changes, dermatitis (a rash of redness and bumps), or burns. Photosensitization (worsening of rash with exposure to sunlight) may occur.
Ingestion: Causes salivation, nausea; vomiting; gastrointestinal tract irritation or bleeding; abdominal pain; rapid, thready pulse; vertigo; headaches; loss of pupillary reflexes; hypothermia; cyanosis; respiratory distress; shock and mild convulsions. Large doses may be fatal.
Carcinogenicity: IARC classifies coal tar creosote as Group 2A: probably carcinogenic to humans: limited human evidence, sufficient animal evidence. NTP classifies coal tar creosote as Group 2B: sufficient evidence of carcinogenicity from studies in experimental animals. OSHA does not specifically classify coal tar creosote as a carcinogen. NIOSH classifies coal tar pitch volatiles, as benzene solubles, as a carcinogen defined with no further categorization.
Medical Conditions Aggravated by Long-Term Exposure: Skin disorders.
Chronic Effects: Include dermatitis and, possibly, skin cancer or other forms of cancer. An increased risk of scrotal cancer for creosote-exposed brick makers was indicated in a worker mortality analysis. Epidemiological studies of coke oven workers reveal increased incidences of lung, bladder, prostate, pancreas, and intestinal cancer.

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Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air, monitor for respiratory distress, 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 or ophthalmologist immediately.
Skin Contact: *Quickly* remove contaminated clothing. Prior to washing and if readily available, use undiluted polyethylene glycol 300 to 400. Wash affected area with soap and flooding amounts of water for at least 15 min. *Do not* rub or apply pressure to the affected skin, apply any oily substance or use hot water to rinse. 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. Rinse the mouth several times with cold water. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not induce vomiting!* Keep victim warm and at rest.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Creosote may be detected in urine.
Special Precautions/Procedures: An exposed person should examine their skin periodically for growths, changes in warts or moles, and sores that do not heal.

Section 5 - Fire-Fighting Measures



Flash Point: 165.2 °F (74 °C)
Flash Point Method: CC
Autoignition Temperature: 637 °F (336 °C)
LEL: None reported.
UEL: None reported.
Flammability Classification: OSHA IIIA combustible liquid
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or regular foam. For large fires, use water spray, fog or regular foam.
Unusual Fire or Explosion Hazards: Coal tar creosote may present a vapor explosion hazard indoors, outdoors, and in sewers. Vapors may travel to an ignition source and flash back.
Hazardous Combustion Products: Include carbon oxides.
Fire-Fighting Instructions: If feasible and without undue risk, remove containers from fire hazard area. Otherwise use water spray to cool fire-exposed containers until well after they are extinguished. *Do not* release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Also, wear full protective clothing. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Immediately leave area if you hear a rising sound from venting safety device or notice any fire-caused tank discoloration as a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Isolate area for 1/2 mile in all directions if fire involves tank, rail car or tank truck. Fully decontaminate or properly dispose of personal protective clothing.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel. Isolate hazard area, deny entry, and stay upwind of spills. Shut off all ignition sources. Cleanup personnel should protect against vapor inhalation and skin and eye contact.
Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal.
Large Spills
Containment: Consider initial downwind evacuation for at least 300 meters (1000 feet). For large spills, dike far ahead of liquid spill for later disposal. Water spray may reduce vapor. *Do not* release into sewers or waterways.
Cleanup: Use nonsparking tools.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation and skin and eye contact. Use ventilation sufficient to reduce airborne exposures to nonhazardous levels (Sec. 2). Wear protective gloves, goggles, and clothing to avoid contact. Wear respiratory protection when necessary (Sec. 8). Consult your industrial hygienist. Practice good personal hygiene procedures to avoid inadvertently ingesting this material. Keep away from ignition sources.
Storage Requirements: Store in a cool, dry, well-ventilated area away from heat and ignition sources. Store coal tar creosote as close to area of use as possible to minimize transporting distance. Avoid physical damage to containers.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose all operations and/or ventilate at the site of release to avoid vapor dispersion into the work area. To prevent static sparks, electrically ground and bond all containers and equipment.

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Ventilation: Provide general or local exhaust ventilation systems equipped with high-efficiency particulate filters to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)

Administrative Controls: Preplacement and periodic medical examinations of exposed workers emphasizing respiratory, skin, liver, and kidney disorders, including comprehensive work and medical history, physical examination, CXR, PFTs, urinalysis, LFT, and sputum cytology as the attending physician considers appropriate. Educate workers about the health and safety hazards associated with coal tar creosote.

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 concentrations above the NIOSH REL or at any detectable concentrations, wear a 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. 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.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent any skin contact. With breakthrough times of >8 hr, butyl rubber, Teflon™, and Viton™ are recommended materials. Frequent change of protective garments is an additional protective measure. Wear protective eyeglasses or chemical 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 contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: 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.

Section 9 - Physical and Chemical Properties

Physical State: Oily liquid

Appearance and Odor: Colorless (pure) or yellow to black (industrial); aromatic smoky smell

Specific Gravity (H_2O=1, at 4 °C): 1.07 to 1.08 at 68 °F (20 °C)

Water Solubility: Slightly soluble

Other Solubilities: Soluble in alcohol; ether; glycerin; dimethyl sulfate; fixed or volatile oils; in solution of fixed alkali hydroxides.

Boiling Point Range: 381 to 752 °F (194 to 400 °C)

Octanol/Water Partition Coefficient: log K_{ow} = 1.0

Heat of Combustion: -12,500 Btu/lb; -6,900 cal/g

Section 10 - Stability and Reactivity

Stability: Coal tar creosote is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Creosote oil mixed with chlorosulfonic acid in a closed container causes an increase in temperature and pressure.

Conditions to Avoid: Avoid excessive heat and contact with chlorosulfonic acid.

Hazardous Decomposition Products: Thermal oxidative decomposition of coal tar creosote can produce carbon oxides and thick, black, acrid smoke.

Section 11 - Toxicological Information

Toxicity Data:*

Genetic Effects:

S. typhimurium: 20 µg/plate (-S9) produced mutations.

Hamster, ovary cell: 10 mg/L induced sister chromatid exchange.

Reproductive Effects:

Mouse, oral: 2 g/kg administered on gestational days 5-9 produced maternal effects and fetotoxicity.

Acute Oral Effects:

Rat, oral, LD_{50}: 725 mg/kg

Mouse, oral, LD_{50}: 433 mg/kg

Tumorigenicity: Mouse, skin, 99 g/kg/33 weeks administered intermittently produced tumors on skin and appendages (carcinogenic by RTECS criteria).

* See NIOSH, *RTECS* (GF8615000), for additional toxicity data.

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Section 12 - Ecological Information

Ecotoxicity: TL_{50}, goldfish (*Carassius auratus*), 3.51 ppm/24 hr (60:40) mixture of creosote and coal tar; TL_{50}, rainbow trout (*Salmo gairdneri*), 3.72 ppm/24 hr (60:40) mixture of creosote and coal tar; LD_{50}, bob white quail (*Colinus virginianus*), 1,260 ppm/8 days (60:40) mixture of creosote and coal tar.
Environmental Fate: Data not found.

Section 13 - Disposal Considerations

Disposal: Coal tar creosote is a good candidate for rotary kiln and fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
Container Cleaning and Disposal: Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Corrosive liquids, n.o.s.
Shipping Symbols: Not listed.
Hazard Class: 8
ID No.: UN1760
Packing Group: I, II, or III*
Label: CORROSIVE
Special Provisions: A7, B10, T42†; B2, T14 ‡; T7 §

Packaging Authorizations
a) Exceptions: None †; 173.154 ‡ §
b) Non-bulk Packaging: 173.201†; 173.202‡; 173.203§
c) Bulk Packaging: 173.243†; 173.242‡; 173.241§

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 0.5 L†; 1 L‡; 5 L§
b) Cargo Aircraft Only: 2.5 L†; 30 L‡; 60 L§

Vessel Stowage Requirements
a) Vessel Stowage: B†; B‡; A§
b) Other: 40†‡§

* See 49 CFR 173.137 to assign Packing Group. Data was not available for Genium to make this determination.
† Packing Group I
‡ Packing Group II
§ Packing Group III

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Material No. U051
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) listed specific per RCRA, Sec. 3001
CERCLA Final Reportable Quantity (RQ), 1 lb (0.454 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Listed (as coal tar pitch volatiles) as an Air Contaminant (29 CFR 1910.1000, Table Z-1)
Listed as an OSHA Specifically Regulated Substance (29 CFR 1910.1002; interpretation of term)

Section 16 - Other Information

References: 73, 103, 124, 136, 139, 184, 196, 197, 198, 200, 209 W5-MAC

Prepared By ..... J Sawyer, MS/MJ Wurth, BS
Industrial Hygiene Review ..... DJ Wilson, CIH
Medical Review ..... G Kelafant, MD

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Material Safety Data Sheets Collection:

Sheet No. 789
Cyanide

Issued: 11/91

Section 1. Material Identification

Cyanide (CN^-) Description: Derived by combining a carbon ion with a nitride ion. Used in rat and pest poisons, silver and metal polishes, photographic solutions, fumigating products, and electroplating solutions. Cyanide may also be liberated in burning of plastics, natural fabrics (wool or silk), polyurethane bedding or furniture, acrylic baths, nylon carpets, and melamine resin insulation.

R 1
I 4
S 2
K 1

Genium



Other Designations: CAS No. 57-12-5, carbon nitride ion, cyanide anion, isocyanide.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*™ for a suppliers list.

HMIS
H 4
F 1
R 1
PPG*
* Sec. 8

Cautions: Cyanide is severely toxic by all routes of entry and its lethal dose is an estimated 1 µg/ml. Take necessary precautions to avoid all possible exposure to this material.

Section 2. Ingredients and Occupational Exposure Limits

Cyanide, ca 100%

1990 OSHA PEL (Skin)
STEL: 4.7 ppm, 5 mg/m³, as hydrogen cyanide (gas)

1991-92 ACGIH TLV (Skin)
Ceiling: 10 ppm, 11 mg/m³, as hydrogen cyanide (gas)

1990 DFG (Germany) MAK (*Danger of cutaneous absorption*)
TWA: 10 ppm, 11mg/m³ as hydrogen cyanide (gas)

1985-86 Toxicity Data*
Mouse, intraperitoneal, LD_{50}: 3 mg/kg; toxic effects not yet reviewed

1990 IDLH Level
50 mg/m³

1990 NIOSH REL (Skin)
STEL: 4.7 ppm, 5 mg/m³ as hydrogen cyanide (gas)

* See NIOSH, *RTECS* (GS7175000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: Varies with specific CN^- compound
Melting Point: Varies with specific CN^- compound
Molecular Weight: 26.02
Density: Varies with specific CN^- compound
Water Solubility: Varies with specific CN^- compound

Appearance and Odor: Varies with specific CN^- compound, but usually has an almond odor.

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** None reported	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Cyanide is combustible. For small fires, use dry chemical, water spray or foam. *Do not use carbon dioxide (CO_2)!* For large fires, use water spray, fog, or regular foam. *Do not scatter* material with more water than needed to extinguish fire.

Unusual Fire or Explosion Hazards: Combustible by chemical reaction with heat, moisture, or acid. Many cyanides readily evolve hydrogen cyanide (HCN), a toxic flammable gas.

Special Fire-fighting Procedures: Since 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 ineffective* for fires involving cyanide. Wear chemical protective clothing that the shipper or manufacturer specifically recommends. If possible without risk, remove container from fire area. Fight fire from maximum distance. Stay away from ends of tanks. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Remove and isolate contaminated clothing at the site.

Section 5. Reactivity Data

Stability/Polymerization: Cyanide is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Cyanide may react violently with hypochlorite solutions at pH 10 to 10.3, is explosive with nitrites if heated above 450 °C, and is incompatible with chlorates, fluorine, magnesium, nitrates, and all inorganic acids.

Conditions to Avoid: Avoid exposure to heat and contact with incompatibles.

Hazardous Products of Decomposition: Thermal oxidative decomposition of cyanide can produce carbon dioxide and toxic, flammable vapors of CN^-.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA do not list cyanide as a carcinogen.

Summary of Risks: Cyanide is a potent, fast-acting, chemical asphyxiant (material which causes pulse and breathing obstruction) that prevents tissue utilization of oxygen by inhibiting the enzyme involved (cytochrome oxidase). Death can occur within seconds to minutes after inhalation of some cyanide gases, and may take as long as an hour after ingestion of a large amount of a cyanide salt due to a slower absorption. Toxicity is dependent on the form of cyanide the victim is exposed to. Mortality from acute exposures is high, but recovery is generally complete in nonfatal cases.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Continue next page

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Section 6. Health Hazard Data, *continued*

Target Organs: Brain, heart, lungs, skin, blood.
Primary Entry Routes: Inhalation, ingestion, skin absorption.
Acute Effects: Inhalation of cyanide gases may cause rapid toxicity where the victim may only have time to utter a warning cry before succumbing to unconsciousness caused by asphyxiation. If exposure is small there may be a weak, rapid, irregular heartbeat with bright-pink coloration of the skin due to high oxyhemoglobin content in the veins before person loses consciousness. A telltale sign of inhalation or ingestion is the odor of bitter almonds on the breath, however up to half the population is genetically unable to detect this smell. Dialated pupils are common in severe poisonings. Contact with broken skin can cause cyanide absorption into the bloodstream. Cyanide ingestion can cause a bitter, burning taste, salivation, nausea, vomiting, anxiety, confusion, vertigo (dizziness), giddiness, sensation of stiffness in the lower jaw, and dyspnea (difficult respiration). In severe cases symptoms could progress to convulsions, paralysis, coma, cardiac arrhythmias, followed by death due to respiratory failure.
Chronic Effects: Chronic skin contact may cause cyanide rash, characterized by itching, and macular (blotches), papular (small, solid, conical, elevation of the skin), and vesicular (blister-like) eruptions. Chronic cyanide inhalation may cause appetite loss, headache, weakness, nausea, dizziness, and symptoms of irritation of the upper respiratory tract and eyes. Other symptoms of chronic exposure include goiter, B12 and folate abnormalities, chest discomfort, epistaxis (nose bleed), poor appetite and sleeping, and functional changes in hearing.
FIRST AID: *Emergency personnel should protect against contamination!*
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *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. If irritation and pain persist, consult a physician.
Inhalation: Remove exposed person to fresh air and immediately begin administering 100% oxygen. Avoid mouth-to-mouth resuscitaton during CPR to prevent self-poisonings.
Ingestion: Obtain and prepare the Lilly cyanide antidote kit [Eli Lilly Co. (Stock No. M76)] for use in symptomatic patients. Never give anything by mouth to an unconscious or convulsing person. Do not induce vomiting with Ipecac syrup. Consider gastric lavage. Activated charcoal is said to be ineffective.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: If the victim is unconscious, bradycardia and absence of cyanosis may be key diagnostic signs. Consider administration of amyl nitrite followed by sodium nitrite and sodium thiosulfate (antidote kit). Consider use of 100% oxygen.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate area, deny entry, and stay upwind. Shut off all ignition sources—no flames, flares, or smoking in hazard area. Cleanup personnel should wear fully encapsulating, vapor-protective clothing for spills or leaks without fire. For small dry spills, carefully scoop into clean, dry, suitable container and cover loosely. For small solution spill, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers. For large spills, dike far ahead of solution spills for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): Hazardous Waste No. P030
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity: *An RQ is not being assigned to the general class* [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: 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 the respirator based on its suitability provide adequate worker protection for the 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 with a full facepiece operated in pressure-demand or other positive-pressure mode. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent repeated or prolonged skin contact.
Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment.
Comments: 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. Cyanide detoxifying kits and instructions should be available in use areas. Instruct employees working in these areas on how and when to use these kits.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in tightly closed and properly labeled containers in cool, dry, well-ventilated area away from heat and incompatibles.
Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control hazardous airborne contaminants and to maintain concentrations at the lowest practical level.
Other Precautions: If respirators are used, implement a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Consider preplacement and periodic medical examinations of exposed workers that emphasize the heart, blood, and respiratory system.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Cyanide *or* cyanide mixture, dry
DOT Hazard Class: Poison B
ID No.: UN1588
DOT Label: Poison
DOT Packaging Exceptions: 173.364
DOT Packaging Requirements: 173.370

IMO Shipping Name: Cyanides, inorganic, n.o.s.
IMO Hazard Class: 6.1
ID No.: UN1588
IMO Label: Poison
IMDG Packaging Group: I/II; Stow 'away from' acids

MSDS Collection **References:** 73, 101, 103, 126, 127, 136, 143, 146, 148, 153, 159, 161, 163
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** AC Darlington, MPH, MD; **Edited by:** JR Stuart, MS

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MATERIAL SAFETY DATA SHEET: CRYSTAL SIMPLE GREEN®

I. PRODUCT & COMPANY INFORMATION

PRODUCT NAME: **CRYSTAL SIMPLE GREEN®**

OTHER NAMES: **CRYSTAL SIMPLE GREEN® - SPECIALIZED CLEANER / DEGREASER**
SIMPLE GREEN SAFETY TOWELS (fluid only)

COMPANY NAME: **SUNSHINE MAKERS, INC.**
15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 • 562-795-6000
Fax: 562-592-3034
Website: www.simplegreen.com

Version No. 4006
Issue Date: January 2002

For 24-hour emergency, call Chem-Tel, Inc.: 800-255-3924

USE OF PRODUCT: A specialized cleaner and degreaser for use in the industrial and institutional workplace..

II. INGREDIENT INFORMATION

The only ingredient of Crystal Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<6%) (Butyl Cellosolve; CAS No. 111-76-2): the OSHA PEL and ACGIH TLV is 25 ppm (skin). Note, however, that Butyl Cellosolve is only one of the raw material ingredients that undergo processing and dilution during the manufacture of Crystal Simple Green®. Upon completion of the manufacturing process, Crystal Simple Green® does not possess the occupational health risks associated with exposure to undiluted Butyl Cellosolve. Verification of this is contained in the independent test results detailed under "Toxicological Information" on Page 3 of this MSDS.

The Butyl Cellosolve in Crystal Simple Green® is part of a chemical category (glycol ethers) regulated by the Emergency Planning and Community Right-to-Know Act (SARA, Title III, section 313); therefore, a reporting requirement exists. Based upon chemical analysis, Crystal Simple Green® contains no known EPA priority pollutants, heavy metals, or chemicals listed under RCRA, CERCLA, or CWA. Analysis by TCLP (Toxicity Characteristic Leaching Procedure) according to RCRA revealed no toxic organic or inorganic constituents.

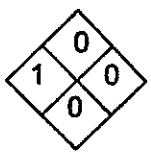
All components of Crystal Simple Green® are listed on the TSCA Chemical Substance Inventory.

III. HAZARDS IDENTIFICATION

UN Number: Not required
Dangerous Goods Class: Nonhazardous

Hazard Rating (NFPA/HMIS)

Health = 1* Reactivity = 0
Fire = 0 Special = 0



Rating Scale

0 = minimal 1 = slight
2 = moderate 3 = serious
4 = severe

*Mild eye irritant, non-mutagenic and non-carcinogenic. **None of the ingredients in Crystal Simple Green® are regulated or listed as potential cancer agents by Federal OSHA, NTP, or IARC.**

IV. FIRST AID MEASURES

SYMPTOMS OF OVEREXPOSURE AND FIRST AID TREATMENT

Eye contact: Reddening may develop. Immediately rinse the eye with large quantities of cool water; continue 10-15 minutes or until the material has been removed; be sure to remove contact lenses, if present, and to lift upper and lower lids during rinsing. Get medical attention if irritation persists.

Skin contact: Minimal effects, if any; rinse skin with water, rinse shoes and launder clothing before reuse. Reversible reddening may occur in some dermal-sensitive users; thoroughly rinse area and get medical attention if reaction persists.

Swallowing: Essentially non-toxic. Give several glasses of water to dilute; do not induce vomiting. If stomach upset occurs, consult physician.

Inhalation: Non-toxic. Exposures to concentrate-mist may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.

V. FIRE FIGHTING MEASURES

Crystal Simple Green® is stable, not flammable, and will not burn.

Flash Point/Auto-Ignition:	Not flammable.
Flammability Limits:	Not flammable.
Extinguishing Media:	Not flammable/nonexplosive. No special procedures required.
Special Fire Fighting Procedures:	None required.

VI. ACCIDENTAL RELEASE MEASURES

Recover usable material by convenient method; residual may be removed by wipe or wet mop. If necessary, unrecoverable material may be washed to drain with large quantities of water.

VII. HANDLING, STORAGE & TRANSPORT INFORMATION

No special precautions are required. **This product is non-hazardous for storage and transport according to the U.S. Department of Transportation Regulations.** Crystal Simple Green® requires no special labeling or placarding to meet U.S. Department of Transportation requirements.

UN Number:	Not required
Dangerous Goods Class:	Nonhazardous

VIII. EXPOSURE CONTROLS

Exposure Limits: The Crystal Simple Green® formulation presents no health hazards to the user when used according to label directions for its intended purposes. Mild skin and eye irritation is possible (please see Eye contact and Skin contact in Section IV.).

Ventilation: No special ventilation is required during use. Large-scale uses indoors should provide an increased rate of air exchange.

Human Health Effects or Risks from Exposure: Adverse effects on human health are not expected from Crystal Simple Green®, based upon twenty years of use of Simple Green without reported adverse health incidence in diverse population groups, including extensive use by inmates of U.S. Federal prisons in cleaning operations.

Crystal Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate-mist.

Crystal Simple Green® is not likely to irritate the skin in the majority of users. Repeated daily application to the skin without rinsing, or continuous contact of Crystal Simple Green® on the skin may lead to temporary, but reversible, irritation.

Medical Conditions Aggravated by Exposure: No aggravation of existing medical conditions is expected; dermal-sensitive users may react to dermal contact by Crystal Simple Green®.

IX. PERSONAL PROTECTION

Precautionary Measures: No special requirements under normal use conditions.
Eye Protection: Caution, including reasonable eye protection, should always be used to avoid eye contact where splashing may occur.
Skin Protection: No special precautions required; rinse completely from skin after contact.
Respiratory Protection: No special precautions required except during large-scale spray applications where spray mist levels are high.
Work and Hygienic Practices: Wash or rinse hands before touching eyes or contact lenses. Follow standard hygienic practices for handling cleaning agents.

X. PHYSICAL AND CHEMICAL PROPERTIES

Appearance/odor::	Clear liquid	Vapor Pressure:	18 mm Hg @ 20 °C; 23.5 mm Hg @ 26 °C
Specific Gravity:	1.020	Vapor Density:	1.3 (air = 1)
pH of concentrate:	9.35	Density:	8.5 lbs./gallon
Evaporation:	>1 (butyl acetate = 1)		
Boiling Point:	100.6 °C (212 °F)		
Freezing Point:	-9 °C (16 °F) If product freezes, it will reconstitute without loss of efficacy when brought back to room temperature and agitated.		

VOC Composite Partial Pressure: 0 mm Hg @ 20 °C
Volatile Organic Compounds (VOCs): 0 g/L per ASTM Method D-2369. Per California AQMD's VOC test method, product must be diluted at least 2 parts of water to 1 part Crystal Simple Green® in order to meet SCAQMD Rule 1171 & Rule 1122 and BAAQMD Regulation 8-16 VOC requirements for solvent cleaning operations.
Water Solubility: Completely soluble in water.
Detection: Crystal Simple Green® has a characteristic odor that is not indicative of any hazardous situation.

XI. STABILITY AND REACTIVITY INFORMATION

Nonreactive. Crystal Simple Green® is stable, even under fire conditions, and will not react with water or oxidizers. Hazardous polymerization will not occur.

XII. TOXICOLOGICAL INFORMATION

The information and conclusions cited in this section are based on data and testing of Simple Green®. The data are directly applicable to Crystal Simple Green® because, except for the fragrance and dyes which have been removed, it contains the same ingredients as Simple Green®.

Nonhuman Toxicity

Acute Mortality Studies:
Oral LD_{50} (rat): >5.0 g/kg body weight // Dermal LD_{50} (rabbit): >2.0 g/kg body weight

Dermal Irritation: Only mild, but reversible, irritation was found in a standard 72-hr test on rabbits. A value of 0.2 (non-irritating) was found on a scale of 8.

Eye Irritation: With or without rinsing with water, the irritation scores in rabbits at 24 hours did not exceed 15 (mild irritant) on a scale of 110.

Subchronic dermal effects: No adverse effects, except reversible dermal irritation, were found in rabbits exposed to Simple Green® (up to 2.0 g/kg/day for 13 weeks) applied to the skin of 25 males and 25 females. Only female body weight gain was affected. Detailed microscopic examination of all major tissues showed no adverse changes.

Fertility Assessment by Continuous Breeding: The Simple Green® formulation had no adverse effect on fertility and reproduction in CD-1 mice with continuous administration for 18 weeks, and had no adverse effect on the reproductive performance of their offspring.

XIII. BIODEGRADABILITY AND ENVIRONMENTAL TOXICITY INFORMATION

Biodegradability:
Like Simple Green®, Crystal Simple Green® is readily decomposed by naturally occurring microorganisms. The biological oxygen demand (BOD), as a percentage of the chemical oxygen demand (COD), after 4, 7, and 11 days was 56%, 60%, and 70%, respectively. Per OECD Closed Bottle Test, Crystal Simple Green® meets OECD and EPA recommendations for ready biodegradability.

In a standard biodegradation test with soils from three different countries, Butyl Cellosolve reached 50% degradation in 6 to 23 days, depending upon soil type, and exceeded the rate of degradation for glucose, which was used as a control for comparison.

Environmental Toxicity Information:
Crystal Simple Green® is considered practically non-toxic per EPA's aquatic toxicity scale.

XIV. DISPOSAL CONSIDERATIONS

Crystal Simple Green® is fully water soluble and biodegradable and will not harm sewage-treatment microorganisms if disposal by sewer or drain is necessary. Dispose of in accordance with all applicable local, state, and federal laws.

XV. OTHER INFORMATION

Containers:	Crystal Simple Green® residues can be completely removed by rinsing with water; the container may be recycled or applied to other uses.
Contact Point:	Sunshine Makers, Inc., Research and Development Division: 562-795-6000.

***** NOTICE *****

All information appearing herein is based upon data obtained by the manufacturer and recognized technical sources. Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of this information, Sunshine Makers, Inc. or its distributors extends no warranties, makes no representations and assumes no responsibility as to the suitability of such information for application to purchaser's intended purposes or for consequences of its use.

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Fuel Oil No. 4

MSDS No. 886

Date of Preparation: 10/93

Section 1 - Chemical Product and Company Identification 42

Product/Chemical Name: Fuel Oil No. 4
Chemical Formula: Not given
CAS No.: 68476-31-3
Synonyms: heating oil
Derivation: A petroleum fraction consisting of heavier straight-run or cracked distillates.
General Use: Used in commercial or industrial burner installations not equipped with preheating facilities.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Fuel Oil No. 4, ca 100 % vol
Trace Impurities: All petroleum fractions contain appreciable amounts of aromatics (toluene, xylene) and saturated rings (cycloparaffins, naphthenes).

OSHA PEL
None established

NIOSH REL
None established

DFG (Germany) MAK
None established

ACGIH TLV
None established

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Fuel oil no. 4 is a moderately dark, viscous liquid. It is flammable when exposed to heat or flame. Prolonged or repeated skin contact may cause dermatitis. It is a DOT flammable liquid.

Wilson Risk Scale
R 1
I -
S 1
K 2

HMIS
H 1
F 2
R 0

PPE†
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion.
Target Organs: Skin, CNS (severe exposure).
Acute Effects
Inhalation: Excessive inhalation of aerosol or mist can cause respiratory tract irritation, headache, dizziness, nausea, increased rate of respiration, tachycardia (excessively rapid heart beat), stupor, convulsions, cyanosis (dark purplish coloration of the skin and mucous membranes caused by deficient blood oxygenation), or unconsciousness, depending on concentration and length of exposure.
Eye: None reported.
Skin: Prolonged or repeated skin contact may cause irritation of the hair follicles and may block the sebaceous glands, producing a rash of acne pimples and spots, usually on arms and legs.
Ingestion: Ingestion may cause nausea, vomiting, diarrhea, and abdominal pain; occasionally, mild CNS depression or excitement occur after ingestion.
Carcinogenicity: IARC lists fuel oils, residual heavy as a possible carcinogen (2B; limited animal data). OSHA and NTP do not list fuel oil no. 4 as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure: Dermatitis.
Chronic Effects: Repeated skin contact may cause defatting and dermatitis.
Comments: Fuel oil no. 4 may be a synergist to pesticides.

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 tepid water for at least 15 min. If pain and irritation persist, consult an ophthalmologist.
Skin Contact: 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, *do not* induce vomiting.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Comments: Following ingestion of hydrocarbons, the primary concern is aspiration into the lungs. Hydrocarbons with the lowest viscosity and surface tension have the greatest risk for aspiration. Fuel oil no. 4 is a viscous liquid and therefore, has a lesser risk for aspiration. Risk for vapor inhalation of fuel oil no. 4 is less than other hydrocarbons such as gasoline or kerosene because fuel oil no. 4 is less volatile. In general, fuel oil no. 4 is more viscous and less toxic than kerosene.

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Section 5 - Fire-Fighting Measures

Flash Point: 142-240 °F (61-116 °C): reported by NFPA; 129 °F (54 °C)

NFPA



Autoignition Temperature: 505 °F (263 °C)
LEL: None reported.
UEL: None reported.
Flammability Classification: Depending on the flash point, fuel oil no. 4 is classified as an OSHA Class II, Class IIIA or IIIB Combustible Liquid.*
Extinguishing Media: For small fires, use dry chemical, CO_2, water spray, or regular foam. For large fires, use water spray, fog, or regular foam.
Unusual Fire or Explosion Hazards: Containers may explode in the heat of fire.
Hazardous Combustion Products: Acrid smoke and irritating fumes.
Fire-Fighting Instructions: If feasible and without undue risk, move containers from fire hazard area. Otherwise, apply cooling water to containers until well after fire is extinguished. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device due to fire. For massive fires, use monitor nozzles or unmanned hose holders. Do not release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: 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 will provide limited protection.
* You will notice that there is a difference in classifications of a flammable and combustible liquid between OSHA and the DOT. The DOT classifies fuel oil (no. 1, 2, 4, 5, 6) as flammable liquids (See Sec. 14).

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel of large spills, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation and skin or eye contact. Clean up spills promptly to reduce fire hazards. Use nonsparking tools.
Small Spills: Use an inert, noncombustible, absorbent material to pick up small spills or residues.
Large Spills
Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.
Cleanup: Consider using straw, polyurethane foam, activated carbon, or peat to soak up oil. There is a wide variety of sorbents, dispersants, sinking agents, combustion promoters, and mechanical systems to treat oil spills.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation or prolonged skin contact.
Storage Requirements: Store in closed containers in a well-ventilated area away from heat and ignition sources. No smoking in storage or use areas.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations.
Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Administrative Controls: Practice good personal hygiene and housekeeping procedures. Do not wear oil contaminated clothing.
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.
Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Barrier creams may be helpful. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.
Comments: 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.

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Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance and Odor: Moderately dark, viscous.
Medium Odor Threshold: 0.5 ppm
Water Solubility: Insoluble
Melting Point: -51 °F (-46 °C)

Section 10 - Stability and Reactivity

Stability: Fuel oil no. 4 is stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization cannot occur.
Chemical Incompatibilities: Oxidizing materials.
Conditions to Avoid: Heat and ignition sources.
Hazardous Decomposition Products: Thermal oxidative decomposition of fuel oil no. 4 can produce various hydrocarbons and hydrocarbon derivatives and partial oxidation products including carbon oxides.

Section 11- Toxicological Information

Toxicity Data: None reported*

* Monitor NIOSH, *RTECS* (LS8965000), for future toxicity data.

Section 12 - Ecological Information

Aquatic Toxicity:
Striped bass, LC_{50}, 96 hr: 25.1 ppm (static test environment)
Carp, LC_{50}, 24 hr: 50 ppm (static test environment)
Striped bass, LC_{50}, 96 hr: 0.62 ppm (static test environment with 1.5 mg/L LAS)
Carp, LC_{50}, 24 hr: 5.1 ppm (static with 1.5 mg/L LAS)

Section 13 - Disposal Considerations

Disposal: Consider incineration (permit-approved facilities only). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Fuel oil (No. 1, 2, 4, 5, or 6)
Shipping Symbols: D
Hazard Class: 3
ID No.: NA1993
Packing Group: III
Label: Flammable Liquid*
Special Provisions (172.102): B1

* DOT defines a flammable liquid as a liquid having a flash point at or above 100 °F (37.8 °C) and not more than 141 °F (60.5 °C). OSHA defines a flammable liquid as any liquid having a flash point below 100 °F.

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.203
c) Bulk Packaging: 173.241

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 60 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: —

Section 15 - Regulatory Information

EPA Regulations:
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Classified as a RCRA Hazardous Waste (40 CFR 261.21): Characteristic of Ignitability [if flash point <140 °F (60 °C)]
CERCLA Hazardous Substance (40 CFR 302.4): Listed if classified as a RCRA Hazardous Waste, Characteristic of Ignitability
CERCLA Reportable Quantity (RQ), 100 lb (45.4 kg)
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
OSHA Regulations:
Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): Not listed

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Section 16 - Other Information

References: 73, 101, 103, 126, 132, 136, 164

Prepared by ..... MJ Wurth, BS
Industrial Hygiene Review ..... DJ Wilson, CIH
Medical Review ..... J Brent, MD, PhD
Revision Notes:

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Material Safety Data Sheets Collection:

Sheet No. 467
Automotive Gasoline, Lead-free

Issued: 10/81 Revision: A, 9/91

Section 1. Material Identification

35

Automotive Gasoline, Lead-free, Description: A mixture of volatile hydrocarbons composed mainly of branched-chain paraffins, cycloparaffins, olefins, naphthenes, and aromatics. In general, gasoline is produced from petroleum, shale oil, Athabasca tar sands, and coal. Motor gasolines are made chiefly by cracking processes, which convert heavier petroleum fractions into more volatile fractions by thermal or catalytic decomposition. Widely used as fuel in internal combustion engines of the spark-ignited, reciprocating type. Automotive gasoline has an octane number of approximately 90. A high content of aromatic hydrocarbons and a consequent high toxicity are also associated with a high octane rating. Some gasolines sold in the US contain a minor proportion of tetraethyllead, which is added in concentrations not exceeding 3 ml per gallon to prevent engine "knock." However, methyl-tert-butyl ether (MTBE) has almost completely replaced tetraethyllead.

R 1
I 2
S 2*
K 4
* Skin absorption

NFPA



HMIS
H 2
F 3
R 1
PPG†
† Sec. 8

Other Designations: CAS No. 8006-61-9, benzin, gasoline, gasolene, motor spirits, natural gasoline, petrol.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Inhalation of automotive gasoline vapors can cause intense burning in throat and lungs, central nervous system (CNS) depression, and possible fatal pulmonary edema. Gasoline is a dangerous fire and explosion hazard when exposed to heat and flames.

Section 2. Ingredients and Occupational Exposure Limits

Automotive gasoline, lead-free*

1990 OSHA PELs
8-hr TWA: 300 ppm, 900 mg/m³
15-min STEL: 500 ppm, 1500 mg/m³

1990-91 ACGIH TLVs
TWA: 300 ppm, 890 mg/m³
STEL: 500 ppm, 1480 mg/m³

1990 NIOSH REL
None established

1985-86 Toxicity Data*
Man, inhalation, TC_{Lo}: 900 ppm/1 hr; toxic effects include sense organs and special senses (conjunctiva irritation), behavioral (hallucinations, distorted perceptions), lungs, thorax, or respiration (cough)
Human, eye: 140 ppm/8 hr; toxic effects include mild irritation
Rat, inhalation, LC_{50}: 300 g/m³/5 min

* A typical modern gasoline composition is 80% paraffins, 14% aromatics, and 6% olefins. The mean benzene content is approximately 1%. Other additives include sulfur, phosphorus, and MTBE.
† See NIOSH, *RTECS* (LX3300000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: Initially, 102 °F (39 °C); after 10% distilled, 140 °F (60 °C); after 50% distilled, 230 °F (110 °C); after 90% distilled, 338 °F (170 °C); final boiling point, 399 °F (204 °C)
Vapor Density (air = 1): 3.0 to 4.0
Density/Specific Gravity: 0.72 to 0.76 at 60 °F (15.6 °C)
Water Solubility: Insoluble

Appearance and Odor: A clear (gasoline may be colored with dye), mobile liquid with a characteristic odor recognizable at about 10 ppm in air.

Section 4. Fire and Explosion Data

Flash Point: -45 °F (-43 °C)	Autoignition Temperature: 536 to 853 °F (280 to 456 °C)	LEL: 1.3% v/v	UEL: 6.0% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or alcohol foam as extinguishing media. Use of water may be ineffective to extinguish fire, but use water spray to knock down vapors and to cool fire-exposed drums and tanks to prevent pressure rupture. Do not use a solid stream of water since it may spread the fuel.
Unusual Fire or Explosion Hazards: Automobile gasoline is an OSHA Class IB flammable liquid and a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow to an ignition source and flash back. Automobile gasoline can also react violently with oxidizing agents.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode, and full protective clothing. When the fire is extinguished, use nonsparking tools for cleanup. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Automotive gasoline is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Automotive gasoline can react with oxidizing materials such as peroxides, nitric acid, and perchlorates.
Conditions to Avoid: Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition of automotive gasoline can produce oxides of carbon and partially oxidized hydrocarbons.

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Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC list gasoline as a possible human carcinogen (Group 2B). Although the IARC has assigned an overall evaluation to gasoline, it has not assigned an overall evaluation to specific substances within this group (inadequate human evidence).
Summary of Risks: Gasoline vapors are considered moderately poisonous. Vapor inhalation can cause central nervous system (CNS) depression and mucous membrane and respiratory tract irritation. Brief inhalations of high concentrations can cause a fatal pulmonary edema. Reported responses to gasoline vapor concentrations are: 160 to 270 ppm causes eye and throat irritation in several hours; 500 to 900 ppm causes eye, nose, and throat irritation, and dizziness in 1 hr; and 2000 ppm produces mild anesthesia in 30 min. Higher concentrations are intoxicating in 4 to 10 minutes. If large areas of skin are exposed to gasoline, toxic amounts may be absorbed. Repeated or prolonged skin exposure causes dermatitis. Certain individuals may develop hypersensitivity. Ingestion can cause CNS depression. Pulmonary aspiration after ingestion can cause severe pneumonitis. In adults, ingestion of 20 to 50 g gasoline may produce severe symptoms of poisoning.
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Skin, eye, respiratory and central nervous systems.
Primary Entry Routes: Inhalation, ingestion, skin contact.
Acute Effects: Acute inhalation produces intense nose, throat, and lung irritation; headaches; blurred vision; conjunctivitis; flushing of the face; mental confusion; staggering gait; slurred speech; and unconsciousness, sometimes with convulsions. Ingestion causes inebriation (drunkenness), vomiting, dizziness, fever, drowsiness, confusion, and cyanosis (a blue to dark purplish coloration of skin and mucous membrane caused by lack of oxygen). Aspiration causes choking, cough, shortness of breath, increased rate of respiration, excessively rapid heartbeat, fever, bronchitis, and pneumonitis. Other symptoms following acute exposure include acute hemorrhage of the pancreas, fatty degeneration of the liver and kidneys, and passive congestion of spleen.
Chronic Effects: Chronic inhalation results in appetite loss, nausea, weight loss, insomnia, and unusual sensitivity (hyperesthesia) of the distal extremities followed by motor weakness, muscular degeneration, and diminished tendon reflexes and coordination. Repeated skin exposure can cause blistering, drying, and lesions.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Give conscious victim a mixture of 2 tablespoons of activated charcoal mixed in 8 oz of water to drink. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Use nonsparking tools. Take up small spills with sand or other noncombustible adsorbent. Dike storage areas to control leaks and spills. Follow applicable OSHA regulations (29 CFR 1910.120).
Aquatic Toxicity: Bluegill, freshwater, LC_{50}, 8 ppm/96 hr.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.21): Characteristic of ignitability
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: 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. There are no specific NIOSH recommendations. However, for vapor concentrations not immediately dangerous to life or health, use chemical cartridge respirator equipped with organic vapor cartridge(s), or a supplied-air respirator. 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.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Materials such as neoprene or polyvinyl alcohol provide excellent/good resistance for protective clothing. **Note:** Resistance of specific materials can vary from product to product.
Ventilation: Provide general and local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IB liquid. Outside or detached storage preferred.
Engineering Controls: Avoid vapor inhalation and skin or eye contact. Consider a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Indoor use of this material requires explosion-proof exhaust ventilation to remove vapors. Only use gasoline as a fuel source due to its volatility and flammable/explosive nature. Practice good personal hygiene and housekeeping procedures. Wear clean work clothing daily.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Gasoline (*including casing-head and natural*)
DOT Hazard Class: Flammable liquid
ID No.: UN1203
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Gasoline
IMO Hazard Class: 3.1
ID No.: UN1203
IMO Label: Flammable liquid
IMDG Packaging Group: II

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 140, 143, 146, 153, 159
Prepared by: M Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS

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Material Safety Data Sheet Collection

Fuel Oil No. 2 **MSDS No. 469**

Date of Preparation: 10/81 Revision: B, 3/98

Section 1 - Chemical Product and Company Identification 51

Product/Chemical Name: Fuel oil no. 2
Chemical Formula: Unspecified or Variable
CAS Number: 68476-30-2
Synonyms: #2 home heating oil; API no. 2 fuel oil; diesel oil; gas oil; home heating oil no. 2; number 2 burner fuel; number 2 fuel oil
Derivation: Residue from distillation (straight run or cracked) of crude oil.
General Use: Used as a fuel in atomizing burners for domestic and industrial heating, in engines of heavy units (ships, trucks, trains), as a source of synthesis gas, in drilling muds, and for mosquito control (coats breeding waters).
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Fuel oil no. 2, ca 100% vol (complex mixture (< 95%) of paraffinic, olefinic, naphthenic, and aromatic hydrocarbons)
Trace Impurities: water and sediment (< 0.05% vol), carbon residue (< 0.35%), ash (< 0.01% wt), sulfur (< 0.7% wt) and benzene (< 100 ppm).

OSHA PEL
As petroleum distillates
8-hr TWA: 500 ppm (2000 mg/m^3)

ACGIH TLV
As diesel fuel
Notice of impending change (1997):
TWA: 100 mg/m^3, *Skin*

NIOSH REL
As petroleum distillates
10-hr TWA: 350 mg/m^3
Ceiling (15 min): 1800 mg/m^3

IDLH Level
As petroleum distillates
1,100 ppm

DFG (Germany) MAK
None established

Section 3 - Hazards Identification

ANSI Signal Word: Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Fuel oil no. 2 is an amber to brown, slighty viscous liquid with a petroleum odor. It can be irritating to the skin and respiratory tract. This low viscosity fuel oil presents a significant aspiration hazard following ingestion, which can result in chemical pneumonitis and respiratory failure. Also Causes: vomiting, diarrhea, central nervous system (CNS) depression, increased rate of respiration, rapid heart beat, and cyanosis (blue coloration of the skin caused by oxygen deficiency). Fuel oil no. 2 can be an environmental hazard if spilled. This flammable liquid is a moderate fire hazard. When heated to decomposition, it will emit acrid smoke and irritating fumes.

Wilson Risk Scale	
R	1
I	2
S	2
K	2

HMIS	
H	1*
F	2
R	0
PPE†	

*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion
Target Organs: Skin, CNS, cardiovascular system (CVS), respiratory system, mucous membranes
Acute Effects

Inhalation: Respiratory tract irritation, headache, dizziness, euphoria, nausea, increased respiration rate, tachycardia (excessively rapid heart beat), cyanosis, stupor, convulsions, and unconsciousness can result from inhalation of fuel oil no. 2 mist.

Eye: Contact may result in irritation.

Skin: Contact may cause irritation.

Ingestion: Gastrointestinal irritation, vomiting, diarrhea, and in severe cases, CNS depression, progressing to coma and death, can result. Since intestinal absorption of longer chain hydrocarbons is minimal, aspiration into lungs following ingestion is a more significant exposure route; it may result in transient CNS depression, hemorrhaging and pulmonary edema, progressing to renal (kidney) involvement, chemical pneumonitis, and respiratory failure.

Carcinogenicity: IARC lists distillate (light) fuel oils as Group 3 (not classifiable as to carcinogenicity to humans). ACGIH lists a notice of impending change for diesel fuels as TLV-A3 (Animal carcinogen). NTP and OSHA do not list fuel oil no. 2 as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

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Chronic Effects: Prolonged and repeated skin contact can cause dermatitis, irritate the hair follicles and may block the (oil) sebaceous glands, producing a rash of acne pimples, usually on the arms and legs. Repeated exposures producing CNS effects may lead to permanent nervous system damage.

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 for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develop.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water followed by washing the 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. *Do not* induce vomiting unless the poison control center advises otherwise.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Gastric lavage for treatment of ingestion is contraindicated due to aspiration hazard. Administer charcoal slurry cathartic (30 g/240 mL diluent). In cases of severe aspiration pneumonitis, consider monitoring arterial blood gases and obtain chest x-ray.

Section 5 - Fire-Fighting Measures

Flash Point: 136 °F (57.78 °C)

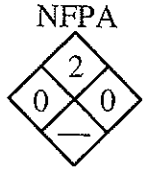
Flash Point Method: CC

Autoignition Temperature: 494 °F (257 °C)

LEL: 0.6% v/v

UEL: 7.5% v/v

NFPA



Flammability Classification: OSHA Class II Combustible Liquid.

Extinguishing Media: Use dry chemical, carbon dioxide, foam, water fog or spray. Water may be ineffective in putting out a fire involving fuel oil no. 2, and a solid water stream may spread the flames; however, a water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.

Unusual Fire or Explosion Hazards: Can form explosive mixtures in air. In still air, the heavier-than-air vapors of fuel oil no. 2 may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Hazardous Combustion Products: Heating fuel oil no. 2 to decomposition can produce thick acrid smoke and irritating fumes.

Fire-Fighting Instructions: If tank, rail car or tank truck is involved in fire isolate for 1/2 mile (800 m). *Do not* release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: 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

Spill /Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Isolate area for at least 80-160 ft (25-50 m) in all directions. Water spray or fire fighting foam may suppress vapor, but may not prevent ignition in closed spaces. Use natural barriers or oil spill control booms to confine oil slicks on surface water.

Small Spills: Absorb fuel oil no. 2 with vermiculite, earth, sand or similar material.

Large Spills

Containment: For large spills, consider downwind evacuation of at least 1000 ft (300 m). Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Cleanup: Ground all equipment. Spills can be absorbed with materials such as peat, activated carbon, polyurethane foam, or straw. Sinking agents, gelling agents, dispersants, and mechanical systems can also be used to treat oil spills. Use clean non-sparking tools to collect absorbed material.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations as low as possible. Wear protective gloves (or use barrier cream) and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

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Storage Requirements: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (See Sec. 10). Periodically inspect stored materials. Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.106) for a Class II Combustible Liquid.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations.

Ventilation: 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: Enclose operations and/or provide local exhaust ventilation at the site of chemical release designed for flammable vapors/mists. Where possible, transfer fuel oil no. 2 from drums or other storage containers to process containers. Minimize sources of ignition in surrounding low-lying areas.

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), use 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.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets of Viton™ or nitrile rubber, if possible, or alternatively, polyvinyl chloride, chlorinated polyethylene or neoprene to prevent skin contact. Butyl rubber may degrade after contact and is not recommended. Wear protective eyeglasses 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.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: 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.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance and Odor: Amber to brown, slightly viscous; petroleum odor

Odor Threshold: 0.082 ppm

Formula Weight: N/A

Specific Gravity (H_2O=1, at 4 °C): 0.8654 at 59 °F (15 °C)

Water Solubility: Slightly soluble

Boiling Point: 450 °F (232 °C)

Freezing Point: -50.8 °F (-46 °C)

Viscosity: 268 centistoke at 100 °F (37.8 °C)

Surface Tension: 25 dynes/cm, estimated

Henry's Law Constant (H): 29 to 68 atm-m^3/mole at 77 °F (25 °C), estimated

Octanol/Water Partition Coefficient: log K_{ow} = 8.2 to 9.7

Soil Sorption Coefficient (K_{oc}): $1x10^4$, estimated

Section 10 - Stability and Reactivity

Stability: Fuel oil no. 2 is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include strong oxidizing agents.

Conditions to Avoid: Heat and ignition sources.

Hazardous Decomposition Products: Thermal oxidative decomposition of fuel oil no. 2 can produce various hydrocarbons, hydrocarbon derivatives, partial oxidation products (carbon dioxide (CO_2), carbon monoxide (CO), sulfur dioxide (SO_2)).

Section 11- Toxicological Information

Toxicity Data:*

Skin Effects:
Rabbit, skin, standard Draize test: 500 mg/24 hr, resulted in moderate irritation.

Acute Dermal Effects:
Rabbit, skin, LD: > 5 g/kg

Acute Oral Effects:
Rat, oral, LD_{50}: 12 g/kg

Eye Effects:
Rabbit, eye, standard Draize test: 100 mg/30 seconds, resulted in mild irritation.

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Section 11- Toxicological Information - *continued*

Toxicity Data:*

Tumorigenicity:
Mouse, skin: 243 g/kg/97 weeks, administered intermittently, caused skin and appendage tumors (carcinogenic by RTECS criteria).

Multiple Dose Toxicity Data:
Rabbit, skin: 100 mL/kg/12 days, continuously, caused irritative dermatitis, weight loss or decreased weight gain, and death.

* See NIOSH, *RTECS* (LS8930000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Juvenile American shad, TLm/24 hr: 200 ppm; bluegill, LC_{50} = 95 mg/L/96 hr; carp, LC_{50} = 8.2 mg/L/24 hr; pumpkin seed, LC_{50} = 1.9 mg/L/24 hr. Through its coating action, this material can pose a hazard to aquatic biota including water birds, plankton, algae and fish.

Environmental Fate: Based on a calculated BCF ($1.02x10^4$ to $1.4x10^4$), bioconcentration could be an important environmental fate process; however, it may be limited for the chief components of fuel oil no. 2 due to metabolism.

Environmental Degradation: It may biodegrade in water and soil, or volatilize from water (half-life of 4.4- 4.8 hours from a model river) and moist soil surfaces, but adsorption may attenuate the rate of these processes. In the atmosphere, fuel oil no. 2 will rapidly degrade by reaction with photochemically produced hydroxyl radicals (estimated half-life 1 day or less).

Soil Adsorption/Mobility: A high Koc indicates significant sorption and low mobility in the soil column.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Material may be sprayed into an incinerator. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Fuel oil (1, 2, 4, 5 or 6)
Shipping Symbols: D
Hazard Class: 3
ID No.: NA1993
Packing Group: III
Label: Flammable Liquid
Special Provisions (172.102): B1

Packaging Authorizations
a) **Exceptions:** 173.150
b) **Non-bulk Packaging:** 173.203
c) **Bulk Packaging:** 173.242

Quantity Limitations
a) **Passenger, Aircraft, or Railcar:** 60 L
b) **Cargo Aircraft Only:** 220 L

Vessel Stowage Requirements
a) **Vessel Stowage:** A
b) **Other:** –

Section 15 - Regulatory Information

EPA Regulations:
Classified as a RCRA Hazardous Waste (40 CFR 261.21), Characteristic of Ignitability
RCRA Hazardous Waste Number: D001
Listed as a CERCLA Hazardous Substance (40 CFR 302.4), Unlisted Hazardous Waste, Characteristic of Ignitability, per RCRA Section 3001
CERCLA Final Reportable Quantity (RQ), 100 lb (45.4 kg)
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, as petroleum distillates)

Section 16 - Other Information

References: 1, 73, 103, 136, 190, 223, 230, 231

Prepared By..... HM Spliethoff, MS
Industrial Hygiene Review..... PA Roy, MPH, CIH
Medical Review..... T Thoburn, MD, MPH

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Material Safety Data Sheet Collection

Diesel Fuel Oil No. 2-D

MSDS No. 470

Date of Preparation: 10/81 Revision: B, 3/98

Section 1 - Chemical Product and Company Identification 51

Product/Chemical Name: Diesel fuel oil no. 2-D
Chemical Formula: Unspecified or variable
CAS Number: 68334-30-5
Synonyms: automotive diesel oil; diesel fuel; diesel oil (medium); diesel oil no. 2; diesel oil (petroleum); diesel oils; diesel test fuel; fuels, diesel; no. 2 diesel oil; olej napeldowy III (Polish)
Derivation: Fuel oil may be a distilled fraction of petroleum, a residuum from refinery operations, a crude petroleum or a blend of two or more of these.
General Use: This medium viscosity residual fuel oil has both light and heavy grades, and is used in furnaces and boilers of utility and industrial power plants, ships, locomotives, and metallurgical operations.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Diesel fuel oil no. 2-D, ca 100% vol; diesel fuels consist primarily of aliphatic (64% vol), aromatic (35% vol), and olefinic (1-2% vol) hydrocarbons.
Trace Impurities: May contain sulfur (< 0.5), benzene (<100 ppm), and additives such as sulfurized esters.

OSHA PEL
As petroleum distillates
8-hr TWA: 500 ppm (2000 mg/m^3)

ACGIH TLV
As diesel fuel
Notice of impending change (1997):
TWA: 100 mg/m^3, *Skin*

NIOSH REL
As petroleum distillates
10-hr TWA: 350 mg/m^3
Ceiling (15 min): 1800 mg/m^3

IDLH Level
As petroleum distillates
1,100 ppm

DFG (Germany) MAK
None established

Section 3 - Hazards Identification

ANSI Signal Word: Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Diesel fuel oil no. 2-D is a brown, slightly viscous liquid with a kerosene-like odor. It is irritating to the skin and respiratory tract. Inhalation of mist or vapor may result in headache, nausea, vomiting, diarrhea, central nervous system (CNS) depression, tachycardia (rapid heart beat), cyanosis (blue coloration of skin due to oxygen deficiency), pulmonary edema (fluid in the lungs), and liver or kidney injury. Diesel fuel oil no. 2-D is an environmental hazard when spilled. When exposed to heat or flame, this flammable liquid is a fire hazard. When heated to decomposition, diesel fuel oil no. 2-D will emit acrid smoke and irritating vapors.

Wilson Risk Scale	
R	1
I	2
S	2*
K	2

*Skin absorption

HMIS	
H	1*
F	2
R	0
PPE†	

*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin contact/absorption
Target Organs: Skin, CNS, cardiovascular system (CVS), respiratory system, liver, kidneys
Acute Effects
Inhalation: Euphoria, respiratory irritation, cardiac dysrhythmia, increased respiration rates, cyanosis, pulmonary edema, hemoptysis (spitting up blood from the respiratory tract), respiratory arrest, renal (kidney) and liver injury, and CNS toxicity can result from inhalation of diesel fuel oil no. 2-D mist or vapor.
Eye: Contact may result in irritation.
Skin: Contact may cause irritation, systemic effects (see Inhalation), and block the sebaceous (oil) glands, resulting in a rash of acne-like pimples and spots, usually on the arms and legs.
Ingestion: Gastrointestinal irritation, vomiting, diarrhea, and in severe cases, CNS depression progressing to coma and death and other systemic effects (see Inhalation) can result. Aspiration can result in transient CNS depression or excitement, hypoxia, infection, pneumatocele (abnormal cavities in lungs) formation, and chronic lung dysfunction.
Carcinogenicity: IARC lists occupational exposure in petroleum refining as Group 2A (Probable human carcinogen) and distillate light (diesel) fuels as Group 3 (Not classifiable as to carcinogenicity to humans). ACGIH lists a notice of impending change for diesel fuels as TLV-A3 (Animal carcinogen). NTP and OSHA do not list diesel fuel oil no. 2-D as a carcinogen.

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Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Prolonged or repeated skin contact causes dermatitis and possible systemic toxicity. Prolonged or repeated inhalation can cause CNS and peripheral nervous system damage.

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 for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develops.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water followed by washing the 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. Have the *conscious and alert* person drink 1 to 2 glasses of water. Contact a poison control center. Because of aspiration risk, *do not* induce vomiting unless the poison control center advises otherwise.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Gastric lavage is contraindicated due to aspiration risk. Instead, consider administration of charcoal or milk. If ingestion amount is large, gastric emptying in the alert patient can be accomplished through administration of Syrup of Ipecac. Treat overexposure symptomatically and supportively.

Section 5 - Fire-Fighting Measures

Flash Point: 100.4 °F (38 °C)

Flash Point Method: CC

Autoignition Temperature: 351-624 °F (177-329 °C)

LEL: 1.3% v/v

UEL: 75% v/v

Flammability Classification: OSHA Class II Combustible Liquid



Extinguishing Media: Use dry chemical, carbon dioxide, foam, low velocity water fog or spray. Use a smothering technique to extinguish fire. Water may be ineffective in putting out a fire involving diesel fuel oil no. 2-D, and a solid water stream may spread the flames; however, a water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.

Unusual Fire or Explosion Hazards: Vapor or mist can form explosive mixtures in air. In still air, the heavier-than-air vapors of diesel fuel oil no. 2-D from a large source may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Hazardous Combustion Products: Heating diesel fuel oil no. 2-D to decomposition can produce acrid smoke and irritating vapors.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: 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

Spill /Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A fire fighting foam may be used to suppress vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

Small Spills: Absorb diesel fuel oil no. 2-D with vermiculite, earth, sand or similar material.

Large Spills

Containment: For large spills, consider downwind evacuation of at least 1000 ft (300 m). Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Cleanup: Ground all equipment. Use non-sparking tools. Spills can be absorbed with materials such as peat, activated carbon, polyurethane foam, or straw. Sinking agents, gelling agents, dispersants, and mechanical systems can also be use to treat oil spills.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves (or use barrier cream), and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

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Storage Requirements: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials. Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.106) for Class II Combustible Liquid.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations.

Ventilation: 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: Enclose operations and/or provide local exhaust ventilation appropriately designed for flammable mist and vapor at the site of chemical release. Where possible, transfer diesel fuel oil no. 2-D from drums or other storage containers directly to process containers. Minimize sources of ignition in surrounding low-lying areas.

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), use 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.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets. Wear protective eyeglasses, 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.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: 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.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance and Odor: Brown, slightly viscous; kerosene-like odor
Odor Threshold: 0.7 ppm
Vapor Pressure: < 0.1 mm Hg at 68 °F (20 °C)
Vapor Density (Air=1): > 6
Formula Weight: N/A

Specific Gravity (H_2O=1, at 4 °C): < 0.86
Water Solubility: Insoluble
Boiling Point: 340-676 °F (171-358 °C)
Freezing Point: -29.2 °F (-34 °C)
Viscosity: 1.9-4.1 centistoke at 104 °F (40 °C)
Surface Tension: 23-32 dynes/cm at 68 °F (20 °C)

Section 10 - Stability and Reactivity

Stability: Diesel fuel oil no. 2-D is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include strong oxidizing agents.

Conditions to Avoid: Exposure to heat and ignition sources.

Hazardous Decomposition Products: Thermal oxidative decomposition of diesel fuel oil no. 2-D can produce low molecular weight hydrocarbons, hydrocarbon derivatives, carbon oxides (CO_x), and sulfur oxides (SO_x).

Section 11- Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 7500 mg/kg

Acute Dermal Effects:
Rabbit, skin, LD: > 5 mL/kg

Skin Effects:
Rabbit, skin, standard Draize test: 500 µL/24 hr, resulted in severe reaction.

Toxicity Data:*

Other Multiple Dose Toxicity Data:
Rat, inhalation: 2 g/m³/6 hr/3 weeks, intermittently, resulted in changes in blood erythrocyte (RBC) count, and focal fibrosis (pneumonoconiosis) and other changes in the lung, thorax or respiration.
Rat, inhalation: 400 µg/m³/16 hr/2.5 years, intermittently, caused other changes in the blood, and biochemical effects - transaminases.
Rabbit, skin: 80 mL/kg/12 days, continuously, resulted in other changes in the liver, kidney, ureter, and bladder, and death.

* See NIOSH, *RTECS* (HZ1800000), for additional toxicity data.

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Section 12 - Ecological Information

Ecotoxicity: Juvenile American shad, salt water TLm: 204 mg/L/24 hr; mallard duck, LD_{50}=20 mg/kg.

Environmental Fate: Diesel fuel oil no. 2-D will evaporate from water or soil. In surface water, it may partition from the water column to suspended sediments.

Environmental Degradation: Biodegradation may occur in soil and water.

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 Transportation Data (49 CFR 172.101):

Shipping Name: Diesel fuel
Shipping Symbols: D
Hazard Class: 3
ID No.: NA1993
Packing Group: III
Label: None
Special Provisions (172.102): B1

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.203
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 60 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: –

Section 15 - Regulatory Information

EPA Regulations:

Classified as RCRA Hazardous Waste (40 CFR 261.21): Characteristic of Ignitability
RCRA Hazardous Waste Number: D001
Listed as a CERCLA Hazardous Substance (40 CFR 302.4), Unlisted Hazardous Waste, Characteristic of Ignitability per RCRA Sec. 3001
CERCLA Final Reportable Quantity (RQ): 100 lb (45.4 kg)
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A, as petroleum distillates)

Section 16 - Other Information

References: 73, 103, 136, 190, 209, 222, 230, 231

Prepared By..... HM Spliethoff, MS
Industrial Hygiene Review..... PA Roy, MPH, CIH
Medical Review..... T Thoburn, MD, MPH

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Material Safety Data Sheet Collection

Thallium **MSDS No. 80**

Date of Preparation: 12/80 Revision: B, 3/98

Section 1 - Chemical Product and Company Identification 51

Product/Chemical Name: Thallium
Chemical Formula: Tl
CAS Number: 7440-28-0
Synonyms: elemental thallium; Ramor; thallium metal
Derivation: Exists in flue dusts from lead and zinc smelters and pyrite burners. Obtained from thallium compounds by electrolysis, precipitation, or reduction.
General Use: Alloyed with mercury for switches and closures which operate at subzero temperatures; used in the manufacture of thallium salts; of mercury alloys and low-melting glasses; used in cardiac imaging; electrodes in dissolved oxygen analyzers; in photoelectric cells, lamps, and electronics; in scintillation counters; as a catalyst in organic synthesis; in magnesium seawater batteries; as a rodenticide (former use).
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Thallium, ca 99.9 - 100%
Trace Impurities (technical grade): lead, zinc, nickel, cadmium, indium, germanium, selenium, tellurium, arsenic

OSHA PEL
Thallium, elemental, and soluble compounds, as Tl
8-hr TWA: 0.1 mg/m^3, *Skin*

ACGIH TLV
Thallium, elemental, and soluble compounds, as Tl
TWA: 0.1 mg/m^3, *Skin*
Excursion Limit: Provided the TLV-TWA is not exceeded, exposure may exceed 0.3 mg/m^3 for no more than 30 min/day, never exceed 0.5 mg/m^3.

NIOSH REL
Thallium, elemental, and soluble compounds, as Tl
10-hr TWA: 0.1 mg/m^3, *Skin*

IDLH Level
15 mg/m^3

DFG (Germany) MAK
Thallium, elemental, and soluble compounds, as Tl
TWA: 0.1 mg/m^3
Category III: Substances with systemic effects, onset of effect >2 hr half-life > shift length (strongly cumulative).
Danger of cutaneous absorption

Peak Exposure Limit:
1.0 mg/m^3, 30 min, average value, frequency per shift: 1

Section 3 - Hazards Identification

ANSI Signal Word: Danger!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Thallium is a bluish-white, odorless soft metal or powder. It is toxic by ingestion and may be absorbed in toxic amounts through skin contact or inhalation. Exposure also causes: skin sensitization, central nervous system (CNS) and gastrointestinal (GI) tract effects, kidney damage, and death. Exposure is cumulative. Thallium dust is flammable.

Wilson Risk Scale
R 2*
I 4
S 3*
K 2
*Powder

HMIS
H 3*
F 2†
R 1
PPE‡
*Chronic effects
†Powder
‡Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin contact
Target Organs: Central nervous system (CNS), peripheral nerves, cardiovascular system (CVS), gastrointestinal (GI) tract, hair, eyes, respiratory system, liver, kidneys

Acute Effects

Inhalation: Irritation and systemic effects including thallium poisoning. Symptoms of thallium poisoning are often delayed 12 to 24 hours and reach a maximum in the second and third week after exposure. Symptoms include severe sudden abdominal pain, nausea, vomiting, diarrhea, headache, chest pain or tightness, excessive salivation, bloody vomit and stools, sensory nerve disorders, painful tingling in extremities, leg pains, insomnia, hypertension (high blood pressure), tachycardia (rapid heart beat), respiratory failure, decreased visual clarity, impaired color vision, weakness, depression, hair loss, green color to urine, kidney damage, and, in severe cases, tremors, delirium, hallucinations, convulsions, paralysis, coma and death, sometimes within 1 to 2 days. Thallium (metal) is not as toxic as some thallium salts.

Eye: Irritation; may cause vision loss.

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Skin: Irritation, acne, hair loss, impaired nail growth ("Mee's lines"); may be absorbed, causing systemic effects.
Ingestion: Sweating, nerve or nerve sheath structural changes, eye muscle changes; may cause systemic effects (see Inhalation).
Carcinogenicity: IARC, NTP, and OSHA do not list thallium as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure: Disorders of the CNS, GI tract, kidneys, liver, and eyes may be worsened by exposure to thallium.
Based on animal studies, thallium may cross the placenta to affect an unborn child.
Chronic Effects: Thallium is a cumulative poison. Chronic effects include systemic effects list under Acute Effects, above, but may also include poor appetite, mood changes, irritability, metallic taste in the mouth, pain in extremities (polyneuritis), alopecia (hair loss), loss of vision, tremor or abnormal muscle jerking, nail changes, dry scaly skin, heart, kidney, and endocrine damage. Permanent brain damage is common.

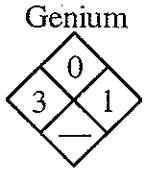
Section 4 - First Aid Measures

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 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. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Monitor for systemic effects.
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. Seek medical attention.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: If over exposure is suspected, monitor cardiac, renal and hepatic function; medical observation for several days is suggested. The most reliable urine test for thallium is a 24-hour urine quantitative assay. Diethylthiocarbamate has been reported to result in dangerous redistribution of thallium to the CNS and is contraindicated.

Section 5 - Fire-Fighting Measures

Flash Point: Not applicable, probable noncombustible solid
Autoignition Temperature: None reported.
LEL: None reported.
UEL: None reported.
Flammability Classification: Probable noncombustible solid

Genium



Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2) or water spray. For large fires, use water spray, fog, or regular foam. Fire involving tanks or car/trailer loads: fight fire from maximum distance or use unmanned hose holders or monitor nozzles. *Do not* get water inside containers. Cool containers with flooding quantities of water until well after fire is out.
Unusual Fire or Explosion Hazards: Thallium dust is flammable when exposed to heat or flame. Reacts violently with fluorine.
Hazardous Combustion Products: Toxic fumes of thallium.
Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. *Do not* scatter thallium.
Fire-Fighting Equipment: 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. Thoroughly decontaminate equipment after use.

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. Tag container as defective and return to supplier. Use spark-proof tools and explosion proof equipment. Cleanup personnel should 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. Collect in sealed containers for disposal.
Large Spills
Containment: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.
Cleanup: If possible, recover for reuse or recycling.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 7 - Handling and Storage

Handling Precautions: Avoid any exposure to thallium. To avoid dust inhalation, use only with exhaust ventilation sufficient to reduce airborne concentrations to nonhazardous levels (see Sec. 2). Wear personal protective clothing and equipment to prevent contact with skin and eyes, or dust inhalation (see Sec. 8). Remove contaminated clothing and equipment immediately for proper decontamination. Practice good personal hygiene procedures to prevent inadvertently ingesting this material. Wash any areas which might have come in contact with thallium at the end of the work shift. *Do not* attempt to handle broken containers without proper protective equipment. Whenever possible, transfer thallium directly form storage containers to process containers.

Storage Requirements: Store in tightly closed containers in a cool, well-ventilated area away from heat, ignition sources, incompatibles, and food and foodstuffs.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations and exhaust ventilate to avoid dust dispersion into the work area. To prevent static sparks, electrically ground and bond all containers and equipment.

Ventilation: Provide local exhaust ventilation systems equipped with appropriate dust collectors or scrubbers to maintain airborne concentrations below OSHA PEL (see 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 and PPE which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the eyes, nervous and respiratory systems, liver, kidneys, gastrointestinal tract, and hair. Monitor workplace exposures.

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. Exposure Range: >0.1 to 1 mg/m^3: air purifying, negative pressure, half mask; >1 to 10 mg/m^3: air purifying, negative pressure, full face; >10 to <15 mg/m^3: supplied air, constant flow/pressure demand, full face; 15 to unlimited mg/m^3: SCBA, pressure demand, full face; cartridge color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter). 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.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent any skin contact. Wear protective eyeglasses or chemical 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.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice disciplined personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance and Odor: Bluish white powder; odorless
Vapor Pressure: 1 mm Hg at 1517 °F (825 °C)
Formula Weight: 204.38
Density: 11.85 g/cm^3
pH: Moderately strong base
Water Solubility: Insoluble
Other Solubilities: Slightly soluble in hydrochloric acid, 100 parts nitric acid; soluble in sulfuric acid.
Boiling Point: 2655 °F (1457 °C)
Melting Point: 578.3 °F (303.5 °C)
Ionization Potential (eV): 6.10829

Section 10 - Stability and Reactivity

Stability: Thallium is stable at room temperature in closed containers under normal storage and handling conditions. Exposure to air will result in surface oxidation.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include strong acids and strong oxidizing agents. Reacts violently with fluourine (F_2). Reacts with steam or moist air to produce toxic thallium hydroxide (TlOH), with air to produce thallium (I) oxide (Tl_2O).

Conditions to Avoid: Avoid contact with chemical incompatibles, heat, and sources of ignition.

Hazardous Decomposition Products: Thermal oxidative decomposition of thallium can produce thallium fumes.

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Section 11- Toxicological Information

Toxicity Data:*

Acute Oral Effects:
Man, oral, TD_{Lo}: 5714 µg/kg produced toxic effects: peripheral nerve and sensation - structural change in nerve or sheath; sense organs and special senses - change in extra-ocular muscles; skin and appendages - hair.

Acute Effects:
Man, unreported exposure route, LD_{Lo}: 4412 mg/kg

* See NIOSH, *RTECS* (XG3425000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Freshwater: Atlantic salmon, LD_{50}: 0.03 ppm; *daphnia*, 72 hr threshold: 2-4 ppm; *gammarus*, 72 hr threshold: 4 ppm; perch, 72 hr threshold: 60 ppm. Saltwater: brown shrimp, 96 hr LC_{50}: 10 ppm.

Environmental Fate: May persist indefinitely as cation. Thallium bioaccumulates.

Section 13 - Disposal Considerations

Disposal: If possible, recover for reuse or recycling. Contact your supplier or a licensed contractor for detailed recommendations for disposal. Follow applicable Federal, state, and local regulations.

Container Cleaning and Disposal: Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Thallium compounds, n.o.s.
Shipping Symbols: –
Hazard Class: 6.1
ID No.: UN1707
Packing Group: II
Label: POISON
Special Provisions (172.102): –

Packaging Authorizations
a) Exceptions: None
b) Non-bulk Packaging: 173.212
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 25 kg
b) Cargo Aircraft Only: 100 kg

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: –

Section 15 - Regulatory Information

EPA Regulations:
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) specific per CWA, Sec. 307(a)
CERCLA Final Reportable Quantity (RQ), 1000 lb (454 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

Section 16 - Other Information

References: 1, 73, 99, 103, 124, 136, 149, 176, 190, 209, 216, 222, 223, 224, 227, 230

Prepared By..... S Fleming, BS/HM Spliethoff, MS
Industrial Hygiene Review..... PA Roy MPH, CIH
Medical Review..... T Thoburn, MD, MPH

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Material Safety Data Sheet Collection

Mercury **MSDS No. 26**

Date of Preparation: 1/77 Revision: D, 6/94

Section 1 - Chemical Product and Company Identification 44

Product/Chemical Name: Mercury
Chemical Formula: Hg
CAS No.: 7439-97-6
Synonyms: colloidal mercury, hydrargyrum, liquid silver, Quicksilver
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.
Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Mercury, ca 100 %wt

OSHA PEL
Ceiling: 0.1mg/m^3 (vapor and inorganic Hg)
8-hr TWA: 0.05 mg/m^3 (vapor), skin; (Vacated 1989 Final Rule Limit)

ACGIH TLVs
TWA: 0.025 mg/m^3 (inorganic compounds), skin

NIOSH REL
10-hr TWA: 0.05 mg/m^3 (vapor), skin

DFG (Germany) MAK
TWA: 0.01 ppm (0.1 mg/m^3)
Category III: Substances with systemic effects
Onset of Effect: > 2 hr
Half-life: > shift length (strongly cumulative)

Peak Exposure Limit:
0.1 ppm (1 mg/m^3), 30 min. average value, 1/shift

IDLH Level
28 mg/m^3

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Mercury exists as a heavy, odorless, silver-white liquid metal. It is highly toxic by both acute and chronic exposure. Exposure can cause corrosion of the eyes, skin, and respiratory tract and may result in irreversible nervous system damage. It readily forms amalgamations with most metals except iron.

Wilson Risk Scale
R 1
I 4
S 2*
K 1
*Skin absorption

HMIS
H 4*
F 0
R 0
*Chronic effects
PPE†
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, eye and skin contact/absorption.
Target Organs: Central nervous system, eyes, skin, respiratory system, liver, kidneys.
Acute Effects
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: IARC, NTP, and OSHA do not list mercury as a carcinogen.
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

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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.

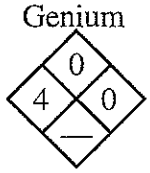
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. In general, mercury will pass through the digestive tract uneventfully.

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

Genium



Flash Point: Nonflammable

Autoignition Temperature: Nonflammable

LEL: None reported.

UEL: None reported.

Extinguishing Media: Use agents suitable for surrounding fire.

Unusual Fire or Explosion Hazards: None reported.

Hazardous Combustion Products: Toxic mercury vapor and mercuric oxide.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: 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

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 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.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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.

Storage Requirements: 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.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Wherever possible, enclose processes to prevent mercury vapor dispersion into work area.

Ventilation: 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.(103)

Administrative Controls: Consider pre-placement and periodic medical exams of exposed workers with emphasis on the skin, eyes, central nervous system, liver, and kidneys.

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 $\leq$ 0.5 mg/m^3, use any chemical cartridge

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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.

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.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: 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.

Section 9 - Physical and Chemical Properties

Physical State: Liquid metal
Appearance and Odor: Silvery-white, odorless
Vapor Pressure: 0.0018 mm Hg at 77 °F (25 °C)
Formula Weight: 200.59
Density (H_2O=1): 13.534 g/cm^3 at 77 °F (25 °C)
Boiling Point: 674.09 °F (356.72 °C)
Freezing Point: -37.97 °F (-38.87 °C)
Viscosity: 15.5 mP at 77 °F (25 °C)
Electrical Resistivity: 95.76 µohm at 68 °F (20 °C)

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.
Surface Tension: 484 dyne/cm at 77 °F (25 °C)
Critical Temperature: 2664 °F (1462 °C)
Critical Pressure: 1587 atm

Section 10 - Stability and Reactivity

Stability: Mercury does not tarnish at ordinary temperatures but when heated to near its boiling point, it slowly oxidizes to mercuric oxide.

Polymerization: Hazardous polymerization does not occur.

Chemical 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.

Conditions to Avoid: Exposure to high temperatures, metal surfaces or incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of mercury can produce mercuric oxide.

Section 11- Toxicological Information

Toxicity Data:*

Reproductive:
Rat, inhalation: 890 ng/m^3/24 hr for 16 weeks prior to mating had an effect on spermatogenesis.

Acute Dermal Toxicity:
Man, skin, TD_{Lo}: 129 mg/kg for 5 continuous hours caused ringing in the ears, headache, and allergic dermatitis.

Acute Oral Toxicity:
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.

Chronic Effects:
Rat, inhalation: 1 mg/m^3/ 24 hr for 5 continuous weeks caused proteinuria.

* See NIOSH, *RTECS* (OV4550000), for additional toxicity data.

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Section 12 - Ecological Information

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.

Environmental Degradation: 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.

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 Transportation Data (49 CFR 172.101):

Shipping Name: Mercury
Shipping Symbols: A, W
Hazard Class: 8
ID No.: UN2809
Packing Group: III
Label: Corrosive
Special Provisions (172.102): --

Packaging Authorizations
a) Exceptions: 173.164
b) Non-bulk Packaging: 173.164
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 35 kg
b) Cargo Aircraft Only: 35 kg

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: 40, 97

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste (40 CFR 261.33): U151
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA, Sec. 3001; CWA, Sec. 307(a), CAA, Sec. 112
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
SARA 311/312 Codes: 1, 2
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 73, 103, 124, 132, 136, 148, 149, 159, 167, 176, 187, 189

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Material Safety Data Sheet Collection

Asbestos **MSDS No. 15**

Date of Preparation: 11/90 Revision: A, 9/97

Section 1 - Chemical Product and Company Identification 50

Product/Chemical Name: Asbestos

Chemical Formula: actinolite, $Ca_2(Fe^{2+}, Mg)_5Si_8O_{22}(OH)_2$; amosite, $(Fe^{2+},Mg)_7Si_8O_{22}(OH)_2$; anthophyllite, $(Mg, Fe^{2+})_7Si_8O_{22}(OH)_2$; chrysotile, $Mg_3Si_2O_5(OH)_4$; crocidolite, $Na_2(Fe^{2+}, Mg)_3Fe^{3+}{}_2Si_8O_{22}(OH)_2$; tremolite, $Ca_2Mg_5Si_8O_{22}(OH)_2$;

CAS Number: CAS No. 1332-21-4, asbestos; CAS No. 12172-73-5, amosite, brown asbestos; CAS No. 12001-29-5, chrysotile, white asbestos; CAS No. 12001-28-4, crocidolite, blue asbestos; CAS No. 17068-78-9, anthophyllite; CAS No. 13768-00-8, actinolite

Synonyms: actinolite; ascarite; amosite; anthophyllite; chrysotile; crocidolite; earth flax; mountain cork; stone flax; tremolite

Derivation: Asbestos is a generic term applied to many naturally occurring, hydrated silicates (minerals) found in rock which separate into flexible fibers when crushed or processed. Commercially important forms are amosite, anthophyllite (mined and used only in Finland), chrysotile, and crocidolite. Other types include tremolite and actinolite.

General Use: Chrysotile was most widely used in US industry. Since asbestos is insensitive to chemical attack and incombustible, asbestos has been used in more than 5,000 products including thermal and electrical insulation, roofing, cement pipe and sheet flooring, friction materials, gaskets, coatings, plastics, textiles, and paper products. However, due to its health hazards, other materials are now replacing it wherever possible. Under TSCA, EPA proposed to prohibit or phase out the manufacture and use of asbestos in certain products. EPA issued a final rule banning the manufacture, importation, processing, and distribution of most asbestos-containing products. Between 1950 and 1972 asbestos was used as spray insulation in buildings, but OSHA now prohibits spray application of actinolite, anthophyllite, asbestos, or tremolite (29 CFR 1910.1001).

Section 2 - Composition / Information on Ingredients

Asbestos, ca 100 %wt

Trace Impurities: Metals including nickel, cobalt, chromium, manganese, beryllium, cadmium, copper, and thallium; other fibrous materials including tremolite and brucite; and oils and waxes.

OSHA PELs*
8-hr TWA: 0.1 f/cc
30-min STEL: 1 f/cc
Carcinogen - See 29 CFR 1910.1001

NIOSH REL*
10-hr TWA: 0.1 f/cc
Carcinogen - Use 29 CFR 1910.1001

DFG (Germany) MAK
None established

ACGIH TLVs†
Amosite (12172-73-5): TWA: 0.5 f/cc ‡
Chrysotile (12001-29-5): TWA: 2 f/cc
Crocidolite (12001-28-4): TWA: 0.2 f/cc
Asbestos, other forms: TWA: 2 f/cc

IDLH Level
Not determined

* The following limits are applicable for amosite (12172-73-5), chrysotile (12001-29-5), crocidolite (12001-28-4), and asbestos, other forms.
† Notice of Intended Change: 0.1 f/cc
‡ Fibers longer than 5 µm; aspect ratio ≥ 3:1 as determined by the membrane filter method at 400-450X magnification (4-mm objective) phase contrast illumination.

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids. Asbestos causes three specific diseases: asbestosis (fibrous lung scarring), lung cancer, and mesothelioma (cancer of the chest lining and abdominal cavities). These diseases typically develop decades (20 to 40 yr) after exposure begins, but may occur sooner. Prevent or minimize asbestos exposure.

Wilson Risk Scale
R 0
I 4
S 1
K 0

HMIS
H 1*
F 0
R 0
PPE†

* Chronic Effects: Cancer Hazard
† Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact

Target Organs: Respiratory system, eyes; possibly digestive system

Acute Effects

Inhalation: Nose and throat irritation are possible with high exposure.

Eye: Irritation.

Skin: Irritation with exposure to high concentrations.

Ingestion: Gastrointestinal tract irritation is possible.

Carcinogenicity: IARC, NTP, OSHA, ACGIH, NIOSH, EPA, and MAK list asbestos as IARC-1 (carcinogenic to humans), NTP-1 (known to be a carcinogen), OSHA-X (carcinogen defined with no further categorization),

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ACGIH-TLV-A1 (confirmed human carcinogen), EPA-A (human carcinogen), and MAK-A1 (capable of inducing malignant tumors as shown by human experience).

Medical Conditions Aggravated by Long-Term Exposure: Long-term, high-level exposure may aggravate any chronic lung (asthma, emphysema, bronchitis) or heart condition.

Chronic Effects: Asbestos may cause 1) asbestosis, 2) lung cancer, 3) mesothelioma, 4) pleural plaques, and 5) several other forms of cancer. *Asbestosis* is fibrosis (scarring) of lung tissue after many years of high-level occupational exposure. Scarring may be progressive even after exposure ceases. Even though detectable in lungs of a high proportion of adults in industrialized areas, asbestosis does not result from lower level environmental exposure. Its symptoms range from mild shortness of breath and dry cough to severe disabling breathlessness, heart failure, and ultimately death. Lung scarring can be seen on X-ray and alterations in lung function can be detected with spirometry (a medical test). Examination typically detects rales (crackling sounds in lungs). Severe cases may have cyanosis (bluish skin discoloration) and clubbing of fingertips. *Lung cancer* can result from lower exposure levels than asbestosis, but also takes many years to develop. Smokers exposed to asbestos are at 5 to 10X higher risk than exposed nonsmokers. *Mesothelioma* is a very aggressive cancer of the pleura (lining around the lungs) or peritoneum (lining of the abdomen), and develops after decades of (sometimes low level) exposure. Symptoms may include chest and abdominal pain, weight loss, and/or shortness of breath, with death within 2 years of diagnosis. *Pleural plaques* are thickenings, sometimes with calcium deposits, of the lung's lining and may be seen on X-ray. While not associated specifically with health effects, they indicate significant exposure. *Other sites of cancer* include larynx (vocal cords), portions of digestive tract, and possibly the kidney. Asbestos's toxicity depends on fiber type (crocidolite > amosite > chrysotile), size (longer > shorter), shape (long, thin needle-like > curly), and solubility. Health effects depend on dose (exposure concentration and duration), smoking habits, and individual susceptibility.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air. Clean any fibers from nose and mouth. Encourage victim to cough, spit, and blow nose to remove fibers.

Eye Contact: Do not rub. Gently lift eyelids and flush with flooding amounts of water.

Skin Contact: Shower with water and soap. Wet contaminated clothing prior to removal and seal in a plastic bag for disposal as hazardous waste. If rash develops, consult physician.

Ingestion: Induce vomiting *only* if awake and alert. Consult a physician.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Asbestosis diagnosis is based on chest X-ray with an abnormal ILO "B" reading (small irregular opacities), rales, restrictive pattern spirometry, adequate exposure history, and symptoms. Consider pneumovax, annual flu shot, and other supportive treatment as needed. See Sec. 8, Administrative Controls for specific recommendations for medical surveillance.

Special Precautions/Procedures: Emergency personnel should protect against any exposure when aiding victims.

Section 5 - Fire-Fighting Measures

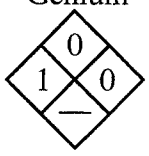
Flash Point: Not applicable (NA); noncombustible solid.

Autoignition Temperature: NA

LEL: NA

UEL: NA

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Extinguishing Media: Use extinguishing media appropriate for surrounding fire. Wet asbestos fibers with water spray to prevent dust generation. *Do not* scatter spilled asbestos with high-pressure water streams.

Unusual Fire or Explosion Hazards: None reported.

Hazardous Combustion Products: None; noncombustible solid.

Fire-Fighting Instructions: Isolate hazard area and deny entry. Avoid asbestos dust generation and inhalation; it may have damaging effects on the lungs. *Do not* release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because there may be airborne asbestos fibers, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel and evacuate all unnecessary personnel. Cleanup personnel should protect against dust inhalation and skin or eye contact. Avoid dust generation, blowing, dry brushing, and dry mopping. Provide HEPA-filtered (high-efficiency particulate air) portable ventilation systems. Use wet cleaning methods or approved HEPA vacuum cleaning system to pick up spills. The techniques used must collect particulate without dispersing dust into air. Place waste in *properly labeled* dust-tight containers or sealed, heavy-gauge, impervious plastic bags for disposal.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid any exposure to asbestos. Work with asbestos only in a sufficient wet state to prevent emission of airborne fibers. Practice good personal hygiene and housekeeping procedures. Use only with ventilation sufficient to reduce airborne concentrations to the lowest feasible level. Wear personal protective clothing and equipment and respiratory protection. Inhaling or ingesting asbestos fibers from contaminated clothing or skin can be hazardous. *Do not* allow dusts and asbestos-containing wastes to accumulate.

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Storage Requirements: Store in closed (dust-tight) containers or heavy-gauge impervious plastic bags in a clean, secure area protected from physical damage. *Do not* open containers that can release asbestos dust without providing proper enclosure or control measure.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose all operations and provide local exhaust ventilation and dust collection systems at the site of release to prevent airborne dispersion.

Ventilation: 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.(103)

Administrative Controls: Educate workers about asbestos and asbestos-containing materials' hazards. Inform employees of asbestos standard (29 CFR 1910.1001). Exposure to asbestos, tremolite, anthophyllite, and actinolite in construction work is covered by 29 CFR 1926.58. Instruct employees in proper practices for handling asbestos-containing materials and correct use of protective equipment. Prevent or minimize asbestos exposure. Regulate areas where exposure in excess of the PEL is likely. Post warning signs in all regulated areas. Do not substitute personal protective equipment for proper handling and engineering controls. If exposures exceed the PEL, ensure employees wear appropriate protective clothing. Monitor work areas that expose employees to airborne concentrations at or above the action level (Sec. 2). Whenever production, process, control equipment, personnel, or work practices change, institute new monitoring. Medical surveillance is required for all employees possibly exposed at or above the action level. Provide preplacement medical examination that includes complete medical and work history, complete physical examination that emphasizes respiratory and cardiovascular systems and digestive tract, the respiratory disease standardized questionnaire, a posterior-anterior 14" x 17" chest roentgenogram, and pulmonary function tests [FVC and FEV(1)]. Annual periodic medical examinations shall include all these elements and an abbreviated questionnaire. Encourage smoking cessation due to synergistic effects of smoking and asbestos exposure. If it is 10+ years since first asbestos exposure, an individual should have a chest roentgenogram: every 5 years (ages 15 to 35), every 2 years (ages 35 to 45), every year (age 45+). Within 30 days of employment termination, an individual should receive a periodic medical examination with the elements listed above. Keep medical surveillance records for duration of employment, plus 30 years.

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. At concentrations above the NIOSH REL or at any detectable concentration, wear any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode (assigned protection factor = 10,000); 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 or other positive-pressure mode (assigned protection factor = 10,000). For escape wear an air-purifying, full-facepiece respirator with a high-efficiency particulate filter; or any appropriate escape-type, SCBA. 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.

Protective Clothing/Equipment: Wear coveralls or gauntlets made of cotton polyester material; head-coverings; and foot coverings such as canvas booties, rubber galoshes or safety shoes. 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 contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Place contaminated protective devices or work clothing in labeled, impermeable, and sealed containers or bags. Separate contaminated work clothes from street clothes. *Do not* remove asbestos from clothing by blowing or shaking. Launder contaminated clothing before wearing. Inform laundering service of asbestos-contaminated clothing and of asbestos' potential harmful effects (29 CFR 1910.1001). A vacuum with HEPA filter may be used to remove asbestos fibers.

Comments: 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.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids

Formula Weight: Varies with asbestos form (See Sec. 1)

Water Solubility: Insoluble

Melting Point: Decomposes

Section 10 - Stability and Reactivity

Stability: Asbestos is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Strong acids can attack chrysotile and rapidly extract its MgO and H_2O content; glacial acetic acid can decompose it. Hot water slowly breaks down chrysotile. Like other asbestos forms, it resists strong alkali [(5M NaOH at least up to 212 °F (100 °C)].

Conditions to Avoid: Airborne dispersion of asbestos fibers.

Hazardous Decomposition Products: It is heat resistant, but decomposes and alters its microscopic fiber structure above 1112 °F (600 °C). Chrysotile dehydroxylates at 1112 to 1436 °F (600 to 780 °C); the "asbestos anhydride" in turn breaks down to a mixture of silica (SiO_2) and fosterite (Mg_2SiO_4) at 1472 to 1562 °F (800 to 850 °C). Above 1832 °F (1000 °C), magnesium pyroxenes form and melt at ~2642 °F (1450 °C).

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Section 11 - Toxicological Information

Toxicity Data:*

Acute Inhalation Effects:
Human, inhalation, TC_{Lo}: 1.2 fb/cc/19 yr/continuous; toxic effects: pleural effusion, dyspnea, and sputum.
Genetic Effects:
E. coli: 10 mg/plate (+/-S9) produced mutations.
Tumorigenicity:
Rat, implant: 750 mg/kg; toxic effects: equivocal tumorigenic agent by RTECS criteria; tumors at site of application.
Mouse, intraperitoneal: 80 mg/kg; toxic effects: equivocal tumorigenic agent by RTECS criteria; tumors at site of application.
* NIOSH, *RTECS* (CI6475000; CAS No.: 1332-21-4)

Section 12 - Ecological Information

Environmental Fate: As a mineral asbestos is not affected by photolytic processes. It is considered to be nonbiodegradable by aquatic organisms; no evidence was found regarding bioaccumulation in aquatic organisms.
Soil Adsorption/Mobility: Although some trace metals and organic compounds have an affinity for asbestos minerals, asbestos itself does not have an adsorptive affinity for the solids normally found in natural water systems.

Section 13 - Disposal Considerations

Disposal: Asbestos is a poor candidate for incineration. Place asbestos and asbestos-containing wastes into good quality plastic bags and bury in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Asbestos
Shipping Symbols: D
Hazard Class: 9
ID No.: NA2212
Packing Group: III
Label: CLASS 9
Special Provisions (172.102): None listed

Packaging Authorizations
a) **Exceptions:** 173.155
b) **Non-bulk Packaging:** 173.216
c) **Bulk Packaging:** 173.240

Quantity Limitations
a) **Passenger, Aircraft, or Railcar:** 200 kg
b) **Cargo Aircraft Only:** 200 kg

Vessel Stowage Requirements
a) **Vessel Stowage:** A
b) **Other:** 34, 40

Section 15 - Regulatory Information

EPA Regulations:
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) specific per CWA, Sec. 307(a) and CAA, Sec. 112.
CERCLA Final Reportable Quantity (RQ), 1 lb (0.454 kg); the RQ is limited to friable forms only
Listed as a SARA Toxic Chemical (40 CFR 372.65), as asbestos (friable); effective date 1/1/87.
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)
Listed as an OSHA Specifically Regulated Substance (29 CFR 1910.1001)

Section 16 - Other Information

References: 73, 103, 124, 136, 139, 147, 167, 184, 190, 197, 198, 209, 223 W5-Mac

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Medical Review ..... G Kelafant, MD

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Material Safety Data Sheets Collection:

Sheet No. 296
Arsenic and Compounds

Issued: 4/90

Section 1. Material Identification

Arsenic Description: Obtained from flue dust of copper and lead smelters as white arsenic (arsenic trioxide). Reduction with charcoal and sublimation in an N_2 current yields pure arsenic. Metallic arsenic is used for hardening copper, lead, and alloys; as a doping agent in germanium and silicon solid-state products, special solders, and medicine; and to make gallium arsenide for dipoles and other electronic devices. Arsenic compounds are used in manufacturing certain types of glass; in textile printing, tanning, taxidermy, pharmaceuticals, insecticides and fungicides, pigment production, and antifouling paints; and to control sludge formation in lubricating oils. Arsenic trioxide is the source for 97% of all arsenic products.

Other Designations: CAS No. 7440-38-2; arsen; arsenic black; As; gray arsenic; metallic arsenic.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R 1
I 4
S 2
K 0

Genium



HMIS
H 3
F 2
R 2
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Arsenic and soluble compounds, as As

OSHA PEL
8-hr TWA: 0.5 mg/m³,* 0.01 mg/m³†

ACGIH TLV, 1989-90
TLV-TWA: 0.2 mg/m³

NIOSH REL, 1987
Ceiling: 0.002 mg/m³

Toxicity Data‡
Man, oral, TD_{Lo}: 76 mg/kg administered intermittently over a 12-year period affects the liver (tumors) and blood (hemorrhage)
Man, oral: 7857 mg/kg administered over 55 years produces gastrointestinal (in the structure or function of the esophagus), blood (hemorrhage), and skin and appendage (dermatitis) changes
Rat, oral, TC_{Lo}: 605 µg/kg administered to a 35-week pregnant rat affects fertility (pre- and post-implantation mortality)

* Organic compounds.
† Inorganic compounds.
‡ See NIOSH, *RTECS* (CG0525000), for additional mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: sublimes at 1134 °F/612 °C
Melting Point: 1497 °F/814 °C
Vapor Pressure: 1 mm at 702 °F/372 °C (sublimes)
Atomic Weight: 74.92
Density: 5.724 at 57 °F/14 °C
Water Solubility: Insoluble†

Appearance and Odor: A brittle, crystalline, silvery to black metalloid. Odorless.

* This data pertains to arsenic only.
† Arsenic is soluble in nitric acid (HNO_3).

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use dry chemical, CO_2, water spray, or foam to fight fires.
Unusual Fire or Explosion Hazards: Flammable and slightly explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Arsenic is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Arsenic can react vigorously on contact with powerful oxidizers such as bromates, peroxides, chlorates, iodates, lithium, silver nitrate, potassium nitrate, potassium permanganate, and chromium (VI) oxide. This material is also incompatible with halogens, bromine azide, palladium, dirubidium acetylide, zinc, and platinum.
Hazardous Products of Decomposition: Thermal oxidative decomposition of arsenic and its compounds produces irritating or poisonous gases.

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Section 6. Health Hazard Data

Carcinogenicity: The IARC, NTP, and OSHA list arsenic as a human carcinogen (Group 1). This evaluation applies to arsenic and arsenic compounds as a whole, and not necessarily to all individual chemicals within the group. Studies report that both the trivalent and pentavalent compounds are strongly implicated as causes of skin, lung, and lymphatic cancers. Experimental studies have shown that arsenic has tumorigenic and teratogenic effects in laboratory animals.
Summary of Risks: Arsenic compounds are irritants of the skin, mucous membranes, and eyes. The moist mucous membranes are most sensitive to irritation. Prolonged contact results in local hyperemia (blood congestion) and later vesicular or pustular eruption. Epidermal carcinoma is a reported risk of exposure. Peripheral neuropathy (degenerative state of the nervous system) is common after acute or chronic arsenic poisoning. Symptoms include decreased sensation to touch, pinprick, and temperature; loss of vibration sense; and profound muscle weakness and wasting. Other complications of acute and chronic arsenic poisoning are encephalopathy (alterations of brain structure) and toxic delirium.
Medical Conditions Aggravated by Long-Term Exposure: Damage to the liver, nervous, and hematopoietic (responsible for the formation of blood or blood cells in the body) system may be permanent. Pulmonary and lymphatic cancer may also occur.
Target Organs: Liver, kidneys, skin, lungs, lymphatic system.
Primary Entry Routes: Inhalation, ingestion of dust and fumes, via skin absorption.
Acute Effects: Acute industrial intoxication is more likely to arise from inhalation of arsine. However, with corrosive arsenical vapors, conjunctivitis, eyelid edema, and even corneal erosion may result. Inhalation may result in nasal irritation with perforation of the septum, cough, chest pain, hoarseness, pharyngitis, and inflammation of the mouth. If ingested, metallic or garlic taste, intense thirst, nausea, vomiting, abdominal pain, diarrhea, and cardiovascular arrhythmias (heartbeat irregularities) may occur. Symptoms generally occur within 30 minutes, but may be delayed for several hours if ingested with food. Acute poisoning may result in acute hemolysis (breakdown of red blood cells).
Chronic Effects: Chronic symptoms include weight loss, hair loss, nausea, and diarrhea alternating with constipation, palmar and plantar hyperkeratoses (thickening of the corneous layer of skin on palms and soles of feet), and skin eruptions, and peripheral neuritis (inflammation of the nerves). Leukemia, bone marrow depression, or aplastic anemia (dysfunctioning of blood-forming organs) may occur after chronic exposure.
FIRST AID
Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.
Skin: *Quickly* remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a *conscious* person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: If emesis is unsuccessful after two doses of ipecac, consider gastric lavage. Monitor urine arsenic level. Alkalinization of urine may help prevent disposition of red cell breakdown products in renal tubular cells. If acute exposure is significant, maintain high urine output and monitor volume status, preferably with central venous pressure line. Abdominal X-rays should be done routinely for all ingestions. Chelation therapy with BAL, followed by n-penicillamine is recommended, but specific dosing guidelines are not clearly established.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of spill, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and contact with skin and eyes. Use nonsparking tools. With a clean shovel, scoop material into a clean, dry container and cover. Absorb liquid material with sand or noncombustible inert material and place in disposal containers. Do not release to sewers, drains, or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations*
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance† (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [† per Clean Water Act, Sec. 307(a); per Clean Air Act, Sec. 112]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations‡
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

* Designations for arsenic only.
‡ Listed as arsenic organic compounds (as As).

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. 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.
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PELs, ACGIH TLVs, and NIOSH REL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed, properly labeled, containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and heat and ignition sources. Protect containers from physical damage.

Engineering Controls: Avoid inhalation or ingestion of dust and fumes, and skin or eye contact. Practice good personal hygiene and housekeeping procedures. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program with training, maintenance, inspection, and evaluation. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement and annual physical examination with emphasis on the skin, respiratory system, and blood.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Arsenic, solid
DOT Hazard Class: Poison B
ID No.: UN1558
DOT Label: Poison
DOT Packaging Requirements: 173.366
DOT Packaging Exceptions: 173.364

IMO Shipping Name: Arsenic, metallic
IMO Hazard Class: 6.1
IMO Label: Poison
IMDG Packaging Group: II
ID No.: UN1558

***MSDS Collection* References:** 7, 26, 38, 53, 73, 85, 87, 88, 89, 100, 103, 109, 123, 124, 126, 127, 130, 136, 138
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD M4

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Material Safety Data Sheets Collection:

Sheet No. 5
Chromic Acid and Chromates

Issued: 10/77 Revision: C, 7/91 Errata: 12/94

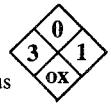
Section 1. Material Identification

45

Chromic Acid (CrO_3) Description: Produced by roasting chromite ore with alkali or lime, leaching with calcium oxide, crystallizing the chromate or dichromate, and then treating it with an excess of sulfuric acid. Used in ceramic glazes, colored glass, dyes, batteries, explosives, water treatment, wood treatment and preservatives, refractories, copper stripping, aluminum anodizing, photomechanical processing, chromium metal plating, purifying oil and acetylene, hardening microscopic preparations, and manufacturing chromated copper arsenate; and as a corrosion inhibitor, a catalyst, an oxidizing agent in organic chemistry, and an etchant for plastics.

R 1
I 4
S 3*
K 0
* Percutaneous (broken skin)

NFPA



HMIS
H 3
F 0
R 1
PPG†
† Sec. 8

Other Designations: CAS No. 1333-82-0; chromic acid; chromic acid, solid (DOT); chromium anhydride; chromium (VI) oxide; chromium trioxide; chromium (6+) trioxide; monochromium trioxide; puratronic chromium trioxide. Chromic acid is the commonly used name, although true chromic acid (CrH_2O_4, CAS No. 7738-94-5) cannot be isolated from solution. Chromic acid and chromates (as CrO_3, CAS No. 7440-47-3).

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Caution: A powerful oxidizer, chromic acid may explode on contact with reducing agents and cause ignition on contact with organic materials. This poison and human carcinogen is corrosive to skin and irritating to mucous membranes. Eye contact may cause permanent blindness.

Section 2. Ingredients and Occupational Exposure Limits

Chromic acid, 99% CrO_3

1990 OSHA PEL
Ceiling: 0.1 mg(CrO_3)/m³

1987 IDLH Level
30 mg/m³

1990-91 ACGIH TLVs
TWA: 0.05 mg(Cr)/m³
Ceiling: 0.1 mg/m³

1990 NIOSH REL
TWA: 0.025 mg(Cr(VI))/m³
Ceiling: 0.05 mg/m³/15 min (Cr(VI))

1985-86 Toxicity Data*
Rat, oral, LD_{50}: 80 mg/kg
Mouse, oral, LD_{50}: 127 mg/kg
Human, inhalation, TC_{Lo}: exposed continuously to 110 µg over 3 years. Toxic effects include tumorigenic (carcinogenic by *RTECS* criteria); sense organs and special senses (olfaction tumors); lungs, thorax, or respiration (tumors).
Dog, subcutaneous, LD_{Lo}: 330 mg/kg

* See NIOSH, *RTECS* (GB6650000), for additional mutative, reproductive, toxicity and tumorigenic data.

Section 3. Physical Data*

Boiling Point: Decomposes at 482 °F (250 °C) to $Cr_2O_3 + O_2$
Melting Point: 385 °F (196 °C)
Molecular Weight: 99.98

Specific Gravity: 2.7
Water Solubility: Soluble
Heat of Fusion: 37.7 cal/g

Appearance and Odor: Dark, purplish-red, prismatic, deliquescent (absorbs all moisture from air) crystals, or a granular powder with no detectable odor.

* These physical data apply only to chromic acid (CAS No. 1333-82-0).

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** None reported	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Chromic acid is noncombustible, but accelerates burning of combustibles (wood, paper, oil). For small fires, *use only water,* not dry chemical, carbon dioxide (CO_2), or halon.

Unusual Fire or Explosion Hazards: A powerful oxidizer, chromic acid ignites on contact with acetic acid and alcohol. It may react rapidly enough with organic materials to cause ignition. Containers may explode if involved in fire.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Cool fire-exposed containers with flooding amounts of water since the decomposing material may form a hot, viscous foam that can cause containers to rupture and explode. *Use caution!* For large fires, flood area from a safe distance, and cool containers from the side with a water spray until after fire is well out. If possible without risk, move containers. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holder. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Chromic acid is generally stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: This material is incompatible with acetic acid, acetic anhydride, acetone, alcohols, alkali metals, ammonia, arsenic, anthracene, benzene, bromine penta fluorine, butyric acid, camphor, chromous sulfide, diethyl ether, glycerol, hydrogen sulfide, methyl alcohol, naphthalene, peroxyformic acid, phosphorus, potassium hexacyanoferrate, pyridine, selenium, sodium, and turpentine. Chromic acid ignites ethyl alcohol and many hydrocarbons.

Conditions to Avoid: Avoid excess heat and contact with combustible or organic materials.

Hazardous Products of Decomposition: Thermal oxidative decomposition of chromic acid can produce carbon dioxide, smoke, and irritating toxic fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC and NTP list chromic acid and other forms of hexavalent (VI) chromium as human carcinogens.

Summary of Risks: Chromic acid is a poison and a powerful irritant to skin, eyes, and respiratory tract. Skin or lung sensitization (allergic reactions) may occur. Exposure can cause dermatitis (skin rash), asthma, pulmonary edema (fluid in lungs), kidney damage, a "chrome hole," or a perforation of the nasal septum (tissue between nostrils).

Medical Conditions Aggravated by Long-Term Exposure: Any chronic lung or skin condition.

Target Organs: Skin, respiratory tract (including nose, throat, airways, and lungs), and kidney.

Primary Entry Routes: Eyes, skin contact, inhalation, and ingestion.

Acute Effects: Inhalation may cause irritation or burning of nose, throat, and air passages, cough, wheezing, and shortness of breath. Higher exposures may cause pulmonary edema (fluid in lungs). Skin exposure may cause dermatitis (skin rash), irritation, burning, itching, redness, and ulceration (skin destruction) which may penetrate. Eye contact can cause irritation, burning, lacrimation (watering), loss of sight and permanent blindness if not removed quickly.

Chronic Effects: Chronic inhalation of excessive levels may cause epistaxis (nosebleed), "chrome holes," nasal congestion, tooth enamel erosion, chest pain, asthma (via allergic sensitization), bronchitis, or respiratory tract cancer. Chronic eye exposure may cause conjunctivitis. Skin contact

Continue on next page

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Section 6. Health Hazard Data, *continued*

can cause irritant or allergic contact dermatitis, or skin ulceration. Chronic systemic absorption could cause liver or kidney damage.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Do not let victim rub eyes or keep them tightly shut. Consult a physician immediately.

Skin: Rinse with flooding amounts of water for at least 15 min, and wash with a gentle soap. Promptly remove contaminated clothing. For redness, blistering, or persistent irritation, consult a physician.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water. *Do not induce vomiting* since this worsens the victim's condition. *Do not* neutralize this acid.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: After decontamination and neutralization, treatment of acid burns is similar to that of thermal burns, although bullae and loose necrotic tissue should be debrided. Update tetanus status. *For severe acid burns,* fluid resuscitation is critical to prevent mortality from hypovolemia and renal failure. Monitor serial vital signs, urine output, electrolytes, blood count, and urinalysis as clinically indicated. Neurovascular compromise distal to a circumferential extremity burn may require escharotomy or fasciotomy. *For inhalation exposures to acids,* a CXR, EKG, ABGs, PFTs, SMA, and CBC may aid in treatment. Evaluate and treat as indicated for reactive airways, upper airway obstruction and noncardiogenic pulmonary edema (possibly delayed onset). Although literature documentation is inadequate, a burst of steroids may help prevent development of sequelae such as reactive airways dysfunction syndrome or bronchilitis obliterans. For ocular exposures to aeids, ensure adequate decontamination. Determination of pH may be helpful. A Morgan Lens© and topical anesthesia may aid in irrigation. Perform fluorescein staining and slit lamp evaluation and consult an opthamalogist. Antibiotic ointments, mydriatic/cycloplegics, topical corticosteroids (after epithelial recovery), patching, and possibly anterior chamber paracentesis may be indicated depending on clinical presentation. Acutely and in follow-up, evaluate as indicated for intraocular pressure, lacrimal and lid function, corneal integrity and infection. Urinary chromium is of questionable value.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel. Cleanup personnel should protect against dust inhalation and eye contact. Do not handle broken packages unless wearing appropriate personal protective equipment. Keep combustibles (wood, paper, etc.) away from spilled material. Whenever possible, use wet cleanup methods; if not, use vacuum cleanup. Remove spills immediately to prevent dust dispersion. For a water spill, neutralize with agricultural lime, crushed limestone, or sodium bicarbonate. For a land spill, dig a pit, pond, or lagoon to contain material. If time permits, seal these with an impermeable, flexible membrane liner. Dike surface flow with soil, sand or foamed concrete. Follow applicable OSHA regulations (29 CFR 1910.120).

Environmental Transport: If allowed contact with soil, chromic acid, solid, lowers pH and may leach into water sources, causing an effect similar to acid rain's on water sources. This material's carcinogenieity makes it hazardous to the environment in its hexavalent state.

Environmental Degradation: The recommended disposal means are reduction, precipitation, or ion exchange. Landfill disposal is not recommended since it raises soil acidity.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.22): Corrosive waste
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 10 lb (4.54 kg) [*per Clean Water Act, Sec. 311(b)(4)]†
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Tables Z-1-A and Z-2)

† Chromic acid (CAS No. 7738-94-5) is listed.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: 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 0.5 mg/m^3 concentrations (if not fumes), use any dust and mist respirator except single-use and quarter-mask respirators. For 1.25 mg/m^3 concentrations, use any powered air-purifying respirator with a high-efficiency particulate filter. For 2.5 mg/m^3 concentrations, use any air-purifying full facepiece respirator with a high-efficiency particulate filter. For 30 mg/m^3 concentrations, use any supplied air respirator with a full facepiece and operated in a pressure-demand or other positive-pressure mode. All concentrations may require eye protection. 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.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below occupational exposure levels. Local exhaust ventilation is preferred since it prevents contaminant dispersion into work area by controlling it at its source.[103]

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Contact lenses may minimize or worsen eye injuries. In some cases, soft lenses can actually protect eyes, not worsen corneal damage, due to strong chemicals. In other cases, chemical entrapment is presumed a possible hazard. Since contact lens use in industry is controversial, establish your own poliey. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store in glass bottles, cans, or drums. Protect against physical damage. Separate from combustible, organic, or other easily oxidizable materials. Protect from excess moisture which could cause containers to rust. Do not store on wooden floors. Store away from foodstuffs and flammable liquids and solids.

Engineering Controls: Avoid dust inhalation and skin or eye contact. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good housekeeping procedures.

Other Precautions: Institute preplacement and periodic medical exams of exposed workers with attention to the skin and respiratory tract. Consider preplacement and periodic chest radiographs.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Chromic acid, solid
DOT Hazard Class: Oxidizer
ID No.: NA1463
DOT Label: Oxidizer
DOT Packaging Exceptions: 173.153
DOT Packaging Requirements: 173.164

IMO Shipping Name: Chromium trioxide, anhydrous
IMO Hazard Class: 5.1
ID No.: UN1463
IMO Label: Oxidizer, Corrosive
IMDG Packaging Group: II

MSDS Collection **References:** 26, 38, 73, 85, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 140, 143, 142, 145, 148, 159

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 686
Hydrogen Cyanide

Issued: 8/89

Section 1. Material Identification

29

Hydrogen Cyanide Description: Large-scale preparation by the catalytic oxidation of ammonia-methane mixtures. Used in the fumigation of ships, railroad cars, orchards, buildings, tabacco, and various foods. Can be produced in petroleum refining, electroplating, metallurgy, and photographic development.
Other Designations: Hydrocyanic acid; prussic aeid; anhydrous hydrogen cyanide; HCN; CAS No. 0074-90-8.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R 1
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S -
K 4



NFPA

HMIS
H 4
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* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Hydrogen cyanide, ca 100%

OSHA PEL (Skin*)
Ceiling: 10 ppm, 10 mg/m³

ACGIH TLV (Skin*), 1988-89
TLV Ceiling: 10 ppm, 10 mg/m³

NIOSH REL, 1976
10-min ceiling: 4.7 ppm CN, 5 mg CN/m³

Toxicity Data†
Human, oral, LD_{Lo}: 570 µg/kg
Human, inhalation, LC_{Lo}: 200 mg/m³/10 min
Rat, inhalation, LC_{50}: 484 ppm/5 min

* This material can be absorbed through intact skin, which contributes to overall exposure.
† See NIOSH, *RTECS* (MW6825000), for additional data with references.

Section 3. Physical Data

Boiling Point: 79 °F (29 °C)
Melting Point: 7.88 °F (-13.4 °C)
Vapor Pressure: 620 torr at 68 °F (20 °C)
Vapor Density (Air = 1): 0.941

Molecular Weight: 27 g/mol
Specific Gravity (H_2O = 1): 0.7
Water Solubility: Miscible
% Volatile by Volume: 100

Appearance and Odor: A colorless gas or blue-white liquid; a characteristic faint odor resembling bitter almonds for those individuals able to perceive its presence by smell.

Section 4. Fire and Explosion Data

Flash Point: 0 °F (-17.78 °C) CC	**Autoignition Temperature:** 1000 °F (538 °C)	**LEL:** 5.6% v/v	**UEL:** 40% v/v

Extinguishing Media: Hydrogen cyanide is an extremely toxic, flammable material. In advanced or massive fires, firefighting should be done from a safe, proteeted location. Use carbon dioxide (CO_2), dry chemical, or foams to put out hydrogen cyanide fires. Use water sprays to cool fire-exposed contaimers, protect the personnel attempting to seal the souree of the leaking gas, flush spills away from sensitive exposures (heat, sources of ignition, or incompatible ehemicals), disperse the vapors, and dilute spills to nonflammable mixtures.
Unusual Fire or Explosion Hazards: This gas is extremely poisonous and flammable. Consider evacuation of the incident area in large fires.
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-dcmand or positive-pressure mode. Fire fighters must wear a complete set of personal protective equipment to prevent virtually any contact with this dcadly poison. They must not have exposed skin surfaees since their skin can absorb fatal amounts of hydrogen cyanide.

Section 5. Reactivity Data

Stability/Polymerization: Hydrogen cyanide is stable at room temperature in during routine operations.. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Hydrogen cyanide can react dangerously with acetaldehyde.
Conditions to Avoid: *Specially trained personnel must handle hydrogen cyanide. Never permit inexperienced workers to handle it.* Never expose this material to any heat or ignition sources such as lighted cigarettes or pipes, open flames, or uninsulated heating elements.
Hazardous Products of Decomposition: Thermal oxidative degradation of hydrogcn cyanide can produce carbon dioxide, toxic oxides of nitrogen (N_xO_y) and carbon monoxide (CO). Hydrogen cyanide is a very toxic material even when not decomposed during fires.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists hydrogen cyanide as a carcinogen.
Summary of Risks: Inhalation of high concentrations of hydrogen cyanide causes tachypnea (rapid breathing) resulting in increased cyanide intake; then dyspnea, paralysis, convulsions, and respiratory arrest. Death may occur withim minutes. Lesser concentrations can cause hcadache, vertigo, nausea, and vomiting. Concentrations of 270 ppm are immediately fatal; 181 ppm in 10 min are fatal; 135 ppm in 30 min are fatal; 110 to 135 ppm in 1 hr are potentially fatal; 45 to 54 ppm are tolerable for 30 to 60 min without immediate or late effects; and 18 to 36 ppm cause slight symptoms after several hours of exposure. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** All body cells. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Burning sensation in mouth and throat. Initially rapid pulse and high blood pressure followed by decreasing blood pressure and pulse. Cherry-red mucous membranes may be noted. Headache, weakness, mental

Continue on next page

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Section 6. Health Hazard Data (continued)

confusion, nausea, vomiting, shock, convulsions, coma, and possible death. **Chronic Effects:** Enlargement of the thyroid gland, fatique, weakness, headache, changes in taste and smell, irritation of throat, effort dyspnea, nervous instability, lachrymation, abdominal colic, and precordial pain were reported in workers exposed at concentrations between 4 and 12 ppm for approximately 7 years.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min. **Skin:** Immediately remove all contaminated clothing. After rinsing affected area with flooding amounts of water, wash it with soap and water. Avoid contact with this chemical. **Inhalation:** Remove the exposcd person to fresh air and support breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion:** Nevcr induce vomiting or perform mouth-to-mouth respiration! Provide 100% oxygen as soon as possible. Institute gastric lavage after endotracheal intubation. **After first aid, get appropriate in-plant, paramedic, or community medical attention and support.** Seek prompt medical assistance for further observation and treatment.

Physician's Note: *Treat all exposures as life-threatening emergencies.* An antidote to hydrogen cyanide is sodium nitrite and sodium thiosulfate. Commereially available cyanide poisoning first-aid kits should be purchased. Competent medical personnel should earefully train appropriately selected workers on how to use these kits in emergencies. Several detailed medical treatments are available for eyanide poisoning. After reviewing the specific uses of hydrogen cyanide in their operation, the safety personnel and/or the industrial hygienists should develop a precise emergency first-aid treatment protocol before an incident occurs. Heart monitorings should be instituted.

Section 7. Spill, Leak, and Disposal Procedures

Spill Leak: *Design and practice a hydrogen cyanide spill control and countermeasure plan (SCCP). Immediately evacuate the incident area and alert the appropriate local officials to the specifics of the hydrogen cyanide release.* When a spill occurs, notify safety personnel, eliminate heat or ignition sources, provide optimum explosion-proof ventilation, and implement the SCCP. Cleanup personnel must wear a complete ensemblc of personal protective equipment (Sec. 8), including self-contained breathing apparatus and total body-covering clothes, to prevent skin contact or inhalation. Use nonsparking tools and equipment. Use water sprays to protect personnel attempting to locate and seal the source of the escaping hydrogen cyanide gas. **Waste Management/ Disposal:** Contact your supplier or a licensed contrator for detailed recommendations. Follow applicable Federal, state, and local regulations.

OSHA Designations

Listed as Air Contaminant (29 CFR 1910.1000, Subpart Z)

EPA Designations

Listed as RCRA Hazardous Waste No. P063 (40 CFR 261.33)

Listed aa a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 10 lb (4.54 kg) [* per CWA, Sec. 311(b)(4) and RCRA, See. 3001]

SARA Extremcly Hazardous Substanee (40 CFR 355), Threshold Planning Quantity (TPQ): 100 lb

SARA Toxic Chemical* (40 CFR 372.65) [* EPA Form R may apply to your facility; see 40 CFR 372.85 for instructions]

Section 8. Special Protection Data

Goggles: Always wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator if necessary. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (leaks or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. **Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne coneentrations below the OSHA PEL standard (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium rcf. 103). **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment. **Other:** Use hydrogen cyanide in closed-confinemcnt, pressurized engineering systems. Automatic shutoff valves/sensors to the main feed lincs are recommended in the event of a catastrophic pressure drop from the rupture of a pressurized HCN pipeline. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Store hydrogen cyanide in tightly closed, airtight, moisture-proof containers in a cool, dry, well-ventilated, fireproof area away from heat or ignition sources and incompatible chemicals (Sec. 5.) Protect these containers from physical damage; shield them from direct sunlight. Limit access to the storage area to authorized personnel only. **Special Handling/Storage:** Proper stock rotation of hydrogen cyanide is vital for safety. Individual HCN cylinders should not be sored longer than 90 days. Check with your supplier for detailed recommendations concerning proper shelf rotation of stock, and proper dispensing equipment such as valves, flanges, and manifolds. **Engineering Controls:** To prevent static sparks, electrically ground and bond all containers, cylinders, and pipelines used in shipping, receiving, or transferring operations in production and storage areas. **Other Precautions:** Consider installing automatic sensing equipment which alerts workers to airborne concentrations of hydrogen cyanide greater than the 10 ppm ceiling (Sec. 2).

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Hydrocyanic acid solution
DOT Hazard Class: Poison A *or* Poison B
DOT ID No. : UN1613 *or* NA1051
DOT Label: Poison gas and flammable gas

IMO Shipping Name: Hydrogen cyanide
IMO Hazard Class: 6.1
IMO Label: Poison and flammable liquid
IMDG Packaging Group: I

Proper shipping names, hazard classes, labels, and identification numbers vary with the hydrogen cyanide's concentration or strength.

MSDS Collection **References:** 1, 6, 7, 84-94, 100, 116, 117, 119, 120, 122

Prepared by: PJ Igoe, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 52
Hydrogen Sulfide

Issued: 7/79 Revision: B, 9/92

Section 1. Material Identification

Hydrogen Sulfide (H_2S) Description: Formed as a byproduct of many industrial processes (breweries, tanneries, slaughter houses), around oil wells, where petroleum products are used, in decaying organic matter, and naturally occurring in coal, natural gas, oil, volcanic gases, and sulfur springs. Derived commercially by reacting iron sulfide with dilute sulfuric or hydrochloric acid, or by reacting hydrogen with vaporized sulfur. Used in the production of various inorganic sulfides and sulfuric acid, in agriculture as a disinfectant, in the manufacture of heavy water, in precipitating sulfides of metals; as a source of hydrogen and sulfur, and as an analytical reagent.

R 2
I 4
S 3
K 3

NFPA



HMIS
H 3
F 4
R 0
PPE*
* Sec. 8

Other Designations: CAS No. 7783-06-4, dihydrogen monosulfide, hydrosulfuric acid, sewer gas, stink damp, sulfuretted hydrogen, sulfur hydride.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Hydrogen sulfide is a highly flammable gas and reacts vigorously with oxidizing materials. It is highly toxic and can be instantly fatal if inhaled at concentrations of 1000 ppm or greater. Be aware that the sense of smell becomes rapidly fatigued at 50 to 150 ppm, and that its strong rotten-egg odor is not noticeable even at very high concentrations.

Section 2. Ingredients and Occupational Exposure Limits

Hydrogen sulfide: 98.5% *technical*, 99.5% *purified*, and CP *(chemically pure grade)*

1991 OSHA PELs
8-hr TWA: 10 ppm (14 mg/m³)
15-min STEL: 15 ppm (21 mg/m³)

1990 IDLH Level
300 ppm

1990 NIOSH REL
10-min Ceiling: 10 ppm (15 mg/m³)

1992-93 ACGIH TLVs
TWA: 10 ppm (14 mg/m³)
STEL: 15 ppm (21 mg/m³)

1990 DFG (Germany) MAK
TWA: 10 ppm (15 mg/m³)
Category V: Substances having intense odor
Peak exposure limit 20 ppm, 10 min momentary value, 4/shift

1985-86 Toxicity Data*
Human, inhalation, LC_{Lo}: 600 ppm/30 min; toxic effects not yet reviewed
Man, inhalation, LD_{Lo}: 5700 µg/kg caused coma and pulmonary edema or congestion.
Rat, intravenous, LD_{50}: 270 µg/kg; no toxic effect noted

* See NIOSH, *RTECS* (MX1225000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: -76 °F (-60 °C)
Freezing Point: -122 °F (-86 °C)
Vapor Pressure: 18.5 atm at 68 °F (20 °C)
Vapor Density (Air = 1): 1.175
pH: 4.5 (freshly prepared saturated aqueous solution)
Viscosity: 0.01166 cP at 32 °F/0 °C and 1 atm
Liquid Surface Tension (est): 30 dyne/cm at -77.8 °F/-61 °C

Molecular Weight: 34.1
Density: 1.54 g/L at 32 °F (0 °C)
Water Solubility: Soluble*; 1g/187 mL (50 °F/10 °C), 1g/242 mL (68 °F/20 °C), 1g/ 314 mL (86 °F/30 °C)
Other Solubilities: Soluble in ethyl alcohol, gasoline, kerosine, crude oil, and ethylene glycol.
Odor threshold: 0.06 to 1.0 ppm†

Appearance and Odor: Colorless gas with a rotten-egg smell.

* H_2S solutions are not stable. Absorbed oxygen causes turbidity and precipitation of sulfur. In a 50:50 mixture of water and glycerol, H_2S is stable.
† Sense of smell becomes rapidly fatigued and can not be relied upon to warn of continuous H_2S presence.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: 500 °F (260 °C)	LEL: 4.3% v/v	UEL: 46% v/v

Extinguishing Media: Let small fires burn unless leak can be stopped immediately. For large fires, use water spray, fog, or regular foam. **Unusual Fire or Explosion Hazards:** H_2S burns with a blue flame giving off sulfur dioxide. Its burning rate is 2.3 mm/min. Gas may travel to a source of ignition and flash back. **Special Fire-fighting Procedures:** 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 fires involving H_2S. If possible without risk, stop leak. Use unmanned device to cool containers until well after fire is out. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: H_2S is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Hydrogen sulfide attacks metals forming sulfides and is incompatible with 1,1-bis(2-azidoethoxy) ethane + ethanol, 4-bromobenzenediazonium chloride, powdered copper + oxygen, metal oxides, finely divided tungsten or copper, nitrogen trichloride, silver fulminate, rust, soda-lime, and all other oxidants. **Conditions to Avoid:** Exposure to heat and contact with incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of hydrogen sulfide can produce toxic sulfur dioxide .

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list hydrogen sulfide as a carcinogen. **Summary of Risks:** H_2S combines with the alkali present in moist surface tissues to form caustic sodium sulfide, causing irritation of the eyes, nose, and throat at low levels (50 to 100 ppm). Immediate death due to respiratory paralysis occurs at levels greater than 1000 ppm. Heavy exposure has resulted in neurological problems, however recovery is usually complete. H_2S exerts most of it's toxicity on the respiratory system. It inhibits the respiratory enzyme cytochrome oxidase, by binding iron and blocking the necessary oxydo-reduction process. Electrocardiograph changes after over-exposure have suggested direct damage to the cardiac muscle, however some authorities debate this. **Medical Conditions Aggravated by Long-Term Exposure:** Eye and nervous system disorders. **Target Organs:** Eyes, respiratory system and central nervous system. **Primary Entry Routes:** Inhalation, eye and skin contact. **Acute Effects:** Inhalation of low levels can cause headache, dizziness, nausea, cramps, vomiting, diarrhea, sneezing, staggering, excitability, pale

Continued on next page

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Section 6. Health Hazard Data, *continued*

complexion, dry cough, muscular weakness, and drowsiness. Prolonged exposure to 50 ppm, can cause rhinitis, bronchitis, pharyngitis, and pneumonia. High level exposure leads to pulmonary edema (after prolonged exposure to 250 ppm), asphyxia, tremors, weakness and numbing of extremeties, convulsions, unconsciousness, and death due to respiratory paralysis. Concentrations near 100 ppm may be odorless due to olfactory fatigue, thus the victim may have no warning. Lactic acidosis may be noted in survivors. The gas does not affect the skin although the liquid (compressed gas) can cause frostbite. The eyes are very susceptible to H_2S keratoconjunctivitis known as 'gas eye' by sewer and sugar workers. This injury is characterized by palpebral edema, bulbar conjunctivitis, mucous-puss secretions, and possible reduction in visible capacity. **Chronic Effects:** Chronic effects are not well established. Some authorities have reported repeated exposure to cause fatigue, headache, inflammation of the conjunctiva and eyelids, digestive disturbances, weight loss, dizziness, a grayish-green gum line, and irritability. Others say these symptoms result from recurring acute exposures. There is a report of encephalopathy in a 20 month old child after low-level chronic exposure. **FIRST AID Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water. Treat with boric acid or isotonic physiologieal solutions. Serious exposures may require adrenaline drops. Olive oil drops (3 to 4) provides immediate treatment until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing and rinse with flooding amounts of water. For frostbite, rewarm in 107.6°F (42 °C) water until skin temperature is normal. *Do not* use dry heat. **Inhalation:** Remove exposed person to fresh air and administer 100% oxygen. Give hyperbaric oxygen if possible. **Ingestion:** Unlikely since H_2S is a gas above -60 °C. **Note to Physicians:** The efficacy of nitrite therapy is unproven. Normal blood contains < 0.05 mg/L H_2S; reliable tests need to be taken within 2 hr of exposure.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources. Use water spray to cool, dilute, and disperse vapors. Neutralize runoff with crushed limestone, agricultural (slaked) lime, or sodium bicarbonate. If leak can't be stopped in place, remove cylinder to safe, outside area and repair or let empty. Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Bluegill sunfish, TLm = 0.0448 mg/L/96 hr at 71.6 °F/22 °C; fathead minnow, TLm = 0.0071 to 0.55 mg/L/96 hr at 6 to 24 °C. **Environmental Degradation:** In air, hydrogen sulfides residency (1 to 40 days) is affected by temperature, humidity, sunshine, and the presence of other pollutants. It does not undergo photolysis but is oxidated by oxygen containing radicals to sulfur dioxide and sulfates. In water, H_2S converts to clemental sulfur. In soil, due to its low boiling point, much of H_2S evaporates quickly if spilled. Although, if soil is moist or precipitation occurs at time of spill, H_2S becomes slightly mobile due to its water solubility. H_2S does not bioaccumulate but is degraded rapidly by certain soil and water bacteria. **Disposal:** Aerate or oxygenate with compressor. For in situ amelioration, carbon removes some H_2S. Anion exchanges may also be effective. A potential candidate for rotary kiln incineration (1508 to 2912 °F/820 to 1600 °C) or fluidized bed incineration (842 to 1796 °F/450 to 980 °C). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U135
SARA Toxic Chemical (40 CFR 372.65): Not listed
Listed as a SARA Extremely Hazardous Substance (40 CFR 355), TPQ: 500 lb
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 100 lb (45.4 kg) [* per RCRA, Sec. 3001 & CWA, Sec. 311 (b)(4)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A & Z-2)
Listed as a Process Safety Hazardous Material (29 CFR 1910.119), TQ: 1500 lb

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** 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 < 100 ppm, use a supplied-air respirator (SAR) or SCBA. For < 250 ppm, use a SAR operated in continuous-flow mode. For < 300 ppm, use a SAR or 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 respiratory protection program that includes at least: a written program, medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polycarbonate, butyl rubber, polyvinyl chloride, and neoprene are suitable materials for PPE. **Ventilation:** Provide general & 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.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Clean PPE. **Comments:** 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.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in steel cylinders in a cool, dry, well-ventilated area away from incompatibles (Sec. 5). Install electrical equipment of Class 1, Group C. Outside or detached storage is preferred. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to keep levels as low as possible. Enclose processes and continuously monitor H_2S levels in the plant air. Keep pipes clear of rust as H_2S can ignite if passed through rusty pipes. Purge and determine H_2S concentration before entering a confined area that may contain H_2S. The worker entering the confined space should have a safety belt and life line and be observed by a worker from the outside. Follow applicable OSHA regulations (1910.146) for confined spaces. H_2S can be trapped in sludge in sewers or process vessels and may be released during agitation. Calcium chloride or ferrous sulfate should be added to neutralize process wash water each time H_2S formation occurs. Control H_2S emissions with a wet flare stack/scrubbing tower. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers emphasizing the eyes, nervous and respiratory system.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Hydrogen sulfide, liquefied
DOT Hazard Class: 2.3
ID No.: UN1053
DOT Packaging Group: --
DOT Label: Poison Gas, Flammable Gas
Special Provisions (172.102): 2, B9, B14

Packaging Authorizations
Exceptions: --
Non-bulk Packaging: 304
Bulk Packaging: 314, 315

Vessel Stowage Requirements
Vessel Stowage: D
Other: 40

Quantity Limitations
Passenger, Aircraft, or Railcar: Forbidden
Cargo Aircraft Only: Forbidden

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 136, 140, 148, 149, 153, 159, 163, 164, 168, 171, 180
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** AC Darlington, MPH, MD

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Material Safety Data Sheets Collection:

Sheet No. 713
Lead (Inorganic)

Issued: 8/90

Section 1. Material Identification 32

Lead (Inorganic) (Pb) Description: Exists widely throughout the world in a number of ores. Its main commercial souree is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, drossing, or electrolytic refming. Lead is used mostly in manufaeturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (brass, pipes, caulking); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a constuction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.
Other Designations: CAS No. 7439-92-1, lead oxide; lead salts, inorganic; metallic lead; plumbum.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R	0
I	4
S	-
K	0

Genium



HMIS
H 3
F 1
R 0
PPG*

Cautions: *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affeeted organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure. * Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

1989 OSHA PELs (Lead, inorganic compounds)
8-hr TWA: 50 μg/m³
Action Level TWA*: 30 μg/m³

29 CFR 1910.1025 Lead Standard
Blood Lead Level: 40 μg/100 g

1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts)
TLV-TWA: 150 μg/m³

1988 NIOSH REL
10-hr TWA: <100 μg/m³

1985-86 Toxicity Data†
Human, inhalation, TC_{Lo}: 10 μg/m³ affects gastrointestinal tract and liver
Human, oral, TD_{Lo}: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, TD_{Lo}: 790 mg/kg affects multigeneration reproduction

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *RTECS* (OF7525000), for additional mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 3164 °F (1740 °C)
Melting Point: 621.3 °F (327.4 °C)
Vapor Pressure: 1.77 mm Hg at 1832 °F (1000 °C)
Viscosity: 3.2 cp at 621.3 °F (327.4 °C)
Molecular Weight: 207.20
Specifie Gravity (20 °C/4 °C): 11.34
Water Solubility: Relatively insoluble in hot or cold water*

Appearance and Odor: Bluish-white, silvery, gray, very soft metal.

* Lead dissolves more easily at a low pH.

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** None reported	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Unusual Fire or Explosion Hazards: Flammable and moderately explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is ineompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
Conditions to Avoid: Rubber gloves containing lead may ignite in nitric acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

Section 6. Health Hazard Data

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
Summary of Risks: Lead is a potent, systemic poison that affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system . The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead ean be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
Medical Conditions Aggravated by Exposure: Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood presssure can aggravate cardiovascular disease.

Continue on next page

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Section 6. Health Hazard Data, *continued*

Target Organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.
Chronic Effects: Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival (gum) tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irritability, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often, ankle extensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if any, symptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage or developmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by severe headache, convulsions, coma, delirium, and possibly death.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Consult a physician if any health complaints develop.
Inhalation: Remove exposed person to fresh air and support breathing as needed. Consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with Ipecac syrup. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic anemia and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and gingival lead line. Use Ca-EDTA to treat poison, but *never* chelate prophylactically. Consult an occupational physician or toxicologist.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dusts or fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formation of dust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled material into closed containers for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applieable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33, Appendix II—EP Toxicity Test Proeedures)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: 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 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.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.
Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially washing hands before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all incompatible materials, direct sunlight, and heat and ignition sources.
Engineering Controls: Educate worker about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid inhalation of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate and launder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures. For a variety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.
Other Precautions: Provide preplacement and periodic medical examinations whieh emphasize blood, nervous system, gastrointestinal tract, and kidneys, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, allergies, smoking history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for medical surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of employment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead absorption level. Maintain worker PbBs at or below 40 µg/100 g of whole blood. To minimize adverse reproductive health effects to parents and developing fetus, maintain the PbBs of workers intending to have children below 30 µg/100 g. Elevated PbBs increase your risk of disease, and the longer you have elevated PbBs, the greater your chance of substantial permanent damage.

Transportation Data (49 CFR 172.102)
IMO Shipping Name: Lead compounds, soluble, n.o.s.
IMO Hazard Class: 6.1
ID No.: UN2291
IMO Label: St. Andrews Cross (X, Stow away from foodstuffs)
IMDG Packaging Group: III

***MSDS Collection* References:** 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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Material Safety Data Sheet Collection

Selenium **MSDS No. 136**

Date of Preparation: 4/88 Revision: A, 3/98

Section 1 - Chemical Product and Company Identification 51

Product/Chemical Name: Selenium
Chemical Formula: Se
CAS Number: 7782-49-2
Synonyms: C.I. 77805; colloidal selenium; elemental selenium; EPA pesticide chemical code 072001; gray selenium; selen (Polish); selenate; selenium alloy; selenium base; selenium (colloidal); selenium dust; selenium elemental; selenium homopolymer; selenium powder; Vandex
Derivation: Recovered by roasting anode muds from electrolytic eopper refineries with soda or sulfuric acid, or by smelting them with soda and niter.
General Use: Used as a pigment and decolorizing agent in the glass industry; in toning baths in photography; in making electrodes for arc lights, electrical instruments and apparatus; rectifier in radio and television sets; in semiconductor fusion mixtures, selenium cells, telephotographic apparatus; rubber vulcanizing agent; catalyst in determination of Kjeldahl nitrogen; for dehydrogenation of organic compounds; in steel and copper (degasifier and machineability improver); as a dietary supplement; in the manufacture of pigments, textiles, petroleum, and medical therapeutic agents.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Selenium, > 99% wt (commercial grade)
Trace Impurities (commercial grade): > 0.2% tellurium, 0.1% iron, 0.005% lead and 0.005% copper.

OSHA PEL
8-hr TWA: 0.2 mg/m^3

ACGIH TLV
TWA: 0.2 mg/m^3
Excursion Limit: Provided the TLV-TWA is not exceeded, exposure may exceed 0.6 mg/m^3 for no more than 30 min/day; never exceed 1.0 mg/m^3.

NIOSH REL
10-hr TWA: 0.2 mg/m^3

IDLH Level
1 mg/m^3

DFG (Germany) MAK
TWA*: 0.1 mg/m^3
Category III: Substances with systemic effects (Onset of effect > 2 hr); Half-life > shift length (strongly cumulative)

Peak Exposure Limit:
1.0 mg/m^3, 30 min, average value, 1/shift

*Measured as the inhalable fraction of the aerosol.

Section 3 - Hazards Identification

ANSI Signal Word: Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Selenium exists as an amorphous red or black solid, or red, gray or black crystals; upon heating, it emits an odor of garlic or rotten horseraddish. Selenium fumes or dust are irritating to the eyes, skin, and mucous membranes. Inhalation of fumes may also result in respiratory system impairment, and central nervous system (CNS) and psychological effects. This combustible solid may burn, but does not ignite readily. Heating selenium can produce fumes of toxic selenium oxides (*e.g.*, selenium dioxide (SeO_2)).

Wilson Risk Scale	
R	1
I	3
S	1
K	1

HMIS	
H	1*
F	1
R	1
PPE†	

*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contaet/absorption
Target Organs: Eyes, skin, CNS, cardiovascular system (CVS), respiratory system, blood, liver, kidneys, spleen
Acute Effects
Inhalation: Inhalation of selenium dust or fumes (fumes contain selenium dioxide - see Skin, below) may cause mucous membrane irritation, coughing, sneezing, breathing difficulty, shortness of breath, "metal fume fever" (chills, fever, headaches), hypotension (low blood pressure), psychological effects (depression, irritability, etc.), liver and kidney damage, and in extreme cases, pulmonary edema (aecumulation of fluid in the lungs), CNS depression, and coma. Note that toxicity of selenium (elemental) is considerably less than that of selenium compounds. Toxic effects of selenium fume inhalation may largely be due to selenium dioxide content of fumes.
Eye: Exposure to dust or fumes may result in irritation, swelling and redness of the eyelids.
Skin: Exposure to selenium fumes causes irritation, contact dermatitis and burns (fumes contain selenium dioxide which forms selenious acid (irritant) upon contact with moist skin or mucous membranes. Both selenium dioxide and selenious acid can also be absorbed through the skin, and produce systemic toxicity).

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Ingestion: Acute systemic effects (see Inhalation) may result, although intestinal absorption of elemental selenium is minimal. Toxic effects ahve been reported following excessive consumption of dietary supplements.

Carcinogenicity: IARC lists selenium as Group 3 (Not classifiable as to carcinogenicity to humans); NTP, Class 2B (Reasonably antieipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals); EPA, Class D (Not classifiable as to human carcinogenicity). OSHA does not list selenium as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Asthma, allergies, known sensitization to selenium, chronic respiratory disease, gastrointestinal disturbanees, liver or kidney disorders, dermatitis.

Chronic Effects: Bronchial irritation (through inhalation), inflammation of eye lining and lids, gastrointestinal distress, persistent garlic odor on breath, increased dental carries, mottled teeth, metallic taste, pallor, skin lesions, lowered blood clotting efficiency and hemoglobin levels, irritability, excessive fatigue, anorexia, pain or anesthesia in extremities, and, in extreme cases of "selenosis," skin discoloration (reddish), fingernail and hair discoloration or loss can result. Some individuals may be more sensitive than others to selenium toxicity. Reported daily ingestion of 27 to 2310 mg resulted in nausea, vomiting, nail changes, fatigue, and irritability. Lower selenium intake (700-800 μg/day) has not been found to produce toxic effects. Animal testing suggests spleen, liver and kidney damage, and reproductive effects.

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 for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develop.

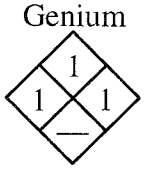
Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

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, then induce vomiting. Consider also administration of charcoal slurry cathartic.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat overexposure symptomatically and supportively. Monitor whole blood selenium levels.

Section 5 - Fire-Fighting Measures



Flash Point: Not applicable; combustible solid.

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

Flammability Classification: Combustible solid

Extinguishing Media: Use extinguishing agents suitable for surrounding fire.

Unusual Fire or Explosion Hazards: Containers may explode in heat of fire.

Hazardous Combustion Products: Heating selenium can produce toxic selenium oxides (*e.g.*, selenium dioxide (SeO_2)).

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: 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

Spill /Leak Procedures: Isolate spill area for at least 80-160 feet (25-50 m). *Do not* touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Cover with plastic sheet to prevent spreading. *Do not* get water inside containers.

Small Spills: Vaeuum or carefully scoop up material and deposit in sealed containers.

Large Spills

Containment: Dike far ahead of spill for later disposal. *Do not* release into sewers or waterways.

Cleanup: Spills of selenium in waterways may be remediated by dredging.

Regulatory Requirements: None reported.

Section 7 - Handling and Storage

Handling Precautions: Avoid dust or fume inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves and clothing (see Sec. 8). Keep away from heat and ignition sources.

Storage Requirements: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose operations and/or provide local exhaust ventilation at the site of chemieal release.

Ventilation: 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: Where possible, use a contained transfer method for transferring selenium from drums or other storage containers to process containers. Arrange pre-employment and annual medical examinations emphasizing urinary selenium (should be < 0.1 mg/L), eyes, skin (chronic disorders), respiratory system, liver, kidneys, blood, and medical conditions aggravated by long-term exposure to selenium (see Sec. 3). Give special consideration to women of childbearing age, because of possible reproductive effects. Remove workers from selenium exposure if exposure-related garlic odor of breath is detected.

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 concentrations ≤ 1 mg/m^3, use a dust and mist, or dust, mist and fume respirator, or air-purifying full face-piece respirator with high efficiency particulate (HEP) filter, or powered air-purifying respirator with dust and mist filter, or powered air-purifying respirator with dust, mist and fume filter, supplied air respirator, or SCBA with full facepiece; > IDLH/unknown/emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or supplied air respirator with full facepiece operated in pressure-demand or other positive-pressure mode in combination with SCBA. For escape, use an air-purifying, full facepiece respirator with HEP filter. *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.

Protective Clothing/Equipment: Wear impervious, chemically protective neoprene or rubber gloves, boots, aprons, gauntlets and body-covering clothing to prevent skin contact. Wear protective eyeglasses, 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.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: 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.

Section 9 - Physical and Chemical Properties

Physical State: Amorphous or crystalline solid

Appearance and Odor: Red to bluish black, dark red, gray, or black, crystals odorless

Vapor Pressure: > 0.001 mm Hg at 68 °F (20 °C)

Formula Weight: 78.96 +/- 3

Specific Gravity (H_2O=1, at 4 °C): 4.26 to 4.81

Water Solubility: Insoluble

Other Solubilities: Soluble in sulfuric acid, carbon disulfide, ether, methylene iodide, benzene, quinoline, chloroform, aqueous potassium cyanide solution, potassium sulfite solution, caustic alkali solution. Insoluble in alcohol.

Boiling Point: 1274 °F (690 °C)

Melting Point: 338 °F (170 °C) to 422.6 °F (217 °C) (crystals)

Surface Tension: 92.5 dynes/cm at 423 °F (217 °C)

Ionization Potential (eV): 9.75238

Section 10 - Stability and Reactivity

Stability: Selenium is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include acids, fluorine, oxygen, cadmium, potassium, sodium, chlorine trifluoride, chromium trioxide, chromic oxide, lithium silicon, nitric acid, nitrogen trichloride, potassium bromate (explosive), silver bromate, bromine pentafluoride, and more materials. Contact with metal amides can be explosive. Metal carbides and chlorates incandesce in selenium vapor upon heating. Freshly precipitated amorphous selenium can react with water, producing selenous acid and hydrogen.

Conditions to Avoid: Unintended contact in storage areas or reactor vessels.

Hazardous Decomposition Products: Thermal oxidative decomposition of selenium can produce selenium dioxide.

Section 11- Toxicological Information

Toxicity Data:*

Genetic Effects:

Human, blood cultures: selenium (more than any tested selenium compounds) induced sister chromatid exchange.

Tumorigenicity:

Mouse, oral: 480 mg/kg/60 days continuous, resulted in tumors of the skin and appendages (equivoeal tumorigenic agent by RTECS criteria).

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Section 11- Toxicological Information, *continued*

Reproductive Effects:
Mouse, oral: 134 mg/kg, over multigenerations resulted in fetotoxicity, and fetal death.

Acute Inhalation Effects:
Rat, inhalation, LC_{Lo}: 33 mg/kg/8 hr resulted in hemorrhage, emphysema, and acute pulmonary edema.

Acute Oral Effects:
Rat, oral, LD_{50}: 6700 mg/kg resulted in somnolence (general depressed activity), dyspnea, other changes in nutrition and gross metabolism.
Mouse, oral, LD_{Lo} 134 mg/kg

* See NIOSH, *RTECS* (VS7700000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: *Scenedesmus*, TLm96=2.5 ppm; *E. Coli*, TLm96=90 ppm. Selenium toxicity occurs frequently among livestock ("alkali disease") of the Great Plains of the US, Canada and Mexico.
Environmental Fate: Selenium undergoes complex chemical and biological cycling through surface water and bottom sediments. It has been found to concentrate in some plants and fish.
Soil Adsorption/Mobility: Elemental selenium is insoluble in water and will have low mobility in the soil column.

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 Transportation Data (49 CFR 172.101):

Shipping Name: Environmentally hazardous substance, solid, n.o.s.*
Shipping Symbols: –
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9
Special Provisions (172.102): 8, B54

Packaging Authorizations
a) Exceptions: 173.155
b) Non-bulk Packaging: 173.213
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: None
b) Cargo Aircraft Only: None

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: –

*Classified as a hazardous substance when this material is one package which equals or exceeds the CERCLA RQ (see Sec. 15).

Section 15 - Regulatory Information

EPA Regulations:
Classified as a RCRA Hazardous Waste (40 CFR 261.24): Characteristic of Toxicity*
RCRA Hazardous Waste Number: D010
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) specific per CWA Section 307(a)†
CERCLA Final Reportable Quantity (RQ), 100 lb. (45.35 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65 as Selenium compounds)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

*May or may not be characterized as a hazardous waste when subjected to the Toxicant Extraction Procedure (40 CFR 261.24).
†No reporting of release is required if diameter of solid pieces is equal to or exceeds 0.004 inches (100 µm).

Section 16 - Other Information

References: 1, 73, 103, 124, 136, 149, 176, 190, 209, 216, 222, 223, 224, 227, 230

Prepared By..... HM Spliethoff, MS
Industrial Hygiene Review..... DJ Wilson, CIH
Medical Review..... G Kelafant, MD

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Appendix C

Heat Stress and Cold Stress Guidelines

Final

Heat Stress Guidelines

Form	Signs & Symptoms	Care	Prevention[3]
Heat Rash	Tiny red vesicles in affected skin area. If the area is extensive, sweating can be impaired.	Apply mild lotions and cleanse the affected area.	Cool resting and sleeping areas to permit skin to dry between heat exposures.
Heat Cramps	Spasm, muscular pain (cramps) in stomach area and extremities (arms and legs).	Provide replacement fluids with minerals (salt) such as Gatorade.	Adequate salt intake with meals[1]. ACCLIMATIZATION[2]
Heat Exhaustion	Profuse sweating, cool (clammy) moist skin, dizziness, confusion, pale skin color, faint, rapid shallow breathing, headache, weakness, and/or muscle cramps.	Remove from heat, sit or lie down, rest, replace lost water with electrolyte replacement fluids (water, Gatorade) take frequent sips of liquids in amounts greater than required to satisfy thirst.	ACCLIMATIZATION[2] Adequate salt intake with meals[1], only during early part of heat season. Ample water intake, frequently during the day.
Heat Stroke	HOT Dry Skin. Sweating has stopped. Mental confusion, dizziness, nausea, chills, severe headache, collapse, delirium, and/or coma.	HEAT STROKE IS A MEDICAL EMERGENCY • Remove from heat. • COOL THE BODY AS RAPIDLY AS POSSIBLE by immersing in cold (or cool) water, or splash with water and fan. • Call for Emergency Assistance. • Observe for signs of shock.	ACCLIMATIZATION[2] Initially moderate workload in heat (8 to 14 days). Monitor worker's activities.

Final

Footnotes:

1.) American diets are normally high in salt, sufficient to aid acclimatization. However, during the early part of the heat season, (May, June), one extra shake of salt during one to two meals per day may help, so long as this is permitted by your physician. Check with your personal physician.

2.) ACCLIMATIZATION - The process of adapting to heat is indicated by worker's ability to perform hot jobs less fluid loss, lower concentrations of salt loss in sweat, and a reduced core (body) temperature and heart rate.

3.) Method to Achieve Acclimatization - Moderate work or exercise in hot temperatures during early part of heat season. Adequate salt (mineral) and water intake. Gradually increasing work time in hot temperatures. Avoid alcohol. Normally takes 8 to 14 days to achieve acclimatization. Lost rapidly, if removed from strenuous work (or exercise) in hot temperature for more than approximately 5 days.

Cold Stress Guidelines

Stress	Symptoms	What to do
Mild Hypothermia	• Body Temp 98 to 90°F • Shivering • Lack of coordination, stumbling, fumbling hands • Slurred speech • Memory loss • Pale, cold skin	• Move to warm area • Stay active • Remove wet clothes and replace with dry clothes or blankets • Cover the head • Drink warm (not hot) sugary drink

Moderate Hypothermia	• Body temp 90 to 86°F
	• Shivering stops
	• Unable to walk or stand
	• Confused and/or irrational
		• All of the above, plus:
		  ○ Call 911
		  ○ Cover all extremities completely
		  ○ Place very warm objects, such as hot packs on the victim's head, neck, chest, and groin

Severe Hypothermia	• Body temp 86 to 78°F • Severe muscle stiffness • Very sleepy or unconscious • Ice cold skin • Death	• Call 911 • Treat victim very gently • Do not attempt to re-warm
Frostbite	• Cold, tingling, stinging, or aching feeling in the frostbitten area, followed by numbness • Skin color turns red, then purple, then white or very pale skin • Cold to the touch • Blisters in severe cases	• Call 911 • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm (not hot) water
Trench Foot	• Tingling, itching, or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm (not hot) sugary drink

Final

Appendix D

Forms

Final

GEI Consultants

Daily Safety Briefing and Site Visitor Sign-In

Project Number:	**Project Name:**
[1]Date:	**Time:**
Briefing Conducted by:	**Signature:**

This sign-in log documents the tailgate briefing conducted in accordance with the site specific HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

TOPICS COVERED (check all those covered):

☐ Accident Reporting Procedures	☐ General PPE Usage	☐ Site Control	☐ Other:
☐ Cellular Phone Charged w/Service	☐ Heat Stress	☐ Site Emergency Procedures	☐ Other:
☐ Changes to the HASP	☐ Hearing Conservation	☐ Slips, Trips, Falls	☐ Other:
☐ Cold Stress	☐ Lockout/Tagout	☐ Traffic Safety	☐ Other:
☐ Confined Space	☐ Personal Hygiene	☐ Other:	☐ Other:
☐ Decon Procedures	☐ Respiratory Protection	☐ Other:	☐ Other:
☐ Exposure Guidelines	☐ Review of Hazards	☐ Other:	☐ Other:

Daily Safety Topic Description:

Personnel Sign-in List

Printed Name	Signature	Company Name	Time-In	Time-Out

[1] This form is applicable for *only* 1 day of site activity.

GEI Consultants

Accident/Incident Report Form

Please complete this form and send it to your Branch Manager, HR and CHSO ***within 24 hours*** of the incident.

SECTION A — ACCIDENT/INCIDENT DETAILS

EMPLOYEE INFORMATION:

Name: _____

Home Address: _____
Street Address City State Zip Code

Contact Information: ( ) ( )
Primary Secondary

Date of Birth: _____

Date of Hire: _____

Branch: _____

Supervisor: _____

OTHER INJURED (IF APPLICABLE):

Name: _____

Home Address: _____
Street Address City State Zip Code

Contact Information: ( ) ( )
Primary Secondary

Date of Birth: _____

Date of Hire: _____

Branch: _____

Supervisor: _____

Date and Time Accident/Incident	Date and Time Reported
____ /____ /____ Month Day Year	____ /____ /____ Month Day Year
____ A.M. ____ P.M.	____ A.M. ____ P.M.

LOCATION OF INCIDENT/ACCIDENT

Project Name: _____

Client and Location: _____

or _____

Office Location: _____

INCIDENT TYPE: (Check All That Applies)

- ☐ **Personal Injury/Illness**
- ☐ **Vehicle Accident**
- ☐ **Property Damage**
- ☐ **Environmental Spill**
- ☐ **Other**

WITNESS INFORMATION

Name: _____

Contact Number: _____

Company: _____

WHAT HAPPENED TO THE INJURED PARTY: ☐First Aid Administered ☐Refused Treatment/Transport ☐Transported to Hospital ☐Returned to Work ☐ Went Home ☐ Went to Physician ☐ Unknown

Clinic/Hospital or Treating Physician: _____ Phone: _____
Name Street Address City State Zip Code

SECTION B — PERSONAL INJURY

Cause of Injury: _____

Part of Body Injured: _____ Multiple Injuries: ☐Y ☐N

Was PPE worn when injured? : ☐Y ☐N What PPE was worn? _____

WAS INJURY A RESULT OF THE USE A MOTOR VEHICLE: ☐ **YES** ☐ **NO** **(If yes, complete Section C)**

GEI Consultants

Accident/Incident Report Form

Please complete this form and send it to your Branch Manager, HR and CHSO ***within 24 hours*** of the incident.

SECTION C — AUTO ACCIDENT ONLY

DRIVER/VEHICLE INFORMATION

Name of Insured: _____

Department: _____

Driver's License Number: _____

DOB: ____/____/____ State: _____

Description of Vehicle: License Plate Number: _____

Make: _____ Model: _____ Year:_____ Color:_____

Owner: _____

Name of Other Driver: _____

Driver's License Number: _____

State: _____

Description of Vehicle: License Plate Number: _____

Make: _____ Model:_____ Year:_____ Color:_____

Insurance Carrier: _____

Policy Number: _____Ph. Number:_____

SECTION D — PROPERTY DAMAGE OR CHEMICAL RELEASE ONLY

Type of Damage(s): _____

Cause of Damage(s): _____

Type of Chemical Released (if known): _____

Quantity of Chemical Released: _____

Spill Measures Employed: _____

SECTION E — NATURE OF ACCIDENT/INCIDENT AND EXTENT OF INJURIES/DAMAGES

(Please give a detailed description of what happened. Attach a sketch or picture if applicable)

_____

_____

_____

_____

_____

_____

_____

_____

_____

I hereby certify that the above information is true and correct to my understanding of this accident/incident.

_____ _____

Employee/Preparer's Name **Date and Time**

NEAR MISS REPORT

A near miss is a potential hazard or incident that has not resulted in any personal injury. Unsafe working conditions, unsafe employee work habits, improper use of equipment, or use of malfunctioning equipment have the potential to cause work related injuries. It is everyone's responsibility to report and/or correct these potential accidents/incidents immediately. Please complete this form as a means to report these near-miss situations. Send a copy of the completed form to the Project Manager, Regional Health and Safety Officer and the Corporate Health and Safety Officer.

Location: _____ Site Name: _____

Date: _____ Time: _____ ☐ a.m. ☐ p.m.

Weather conditions, site operations taking place during near miss. _____

Please check all appropriate conditions:

☐ Unsafe Act ☐ Unsafe equipment

☐ Unsafe Condition ☐ Unsafe use of equipment

Description of incident or potential hazard: _____

Employees or sub-contractors involved if applicable._____

Employee Signature _____ Date _____

Print Name _____

NEAR MISS INVESTGATION

Description of the near-miss condition: _____
Causes (primary & contributing) _____
Corrective action taken (Remove the hazard, replace, repair, or retrain in the proper procedures for the task) _____
Actions not yet taken_____

Signed: _____ Date Completed: _____

Print Name
Not completed for the following reason: _____Date:_____

GEI Consultants

Project Safety Briefing Form

Project Number:	**Project Name:**
Date:	**Time:**
Briefing Conducted by:	**Signature:**

This sign-in log documents that a project specific-briefing was conducted in accordance with the site-specific HASP and GEI's H&S policy. GEI personnel who perform work on site are required to attend this project briefing. Applicable health and safety SOPs and any additional hazards are also required to be reviewed during this briefing. Prior to the start of the project or upon the start of a new on-site project team member, this form must be completed. Please email this completed form to: *HealthandSafety@geiconsultants.com*

TOPICS COVERED (check all those covered):			
SOP HS-001 Biological Hazards		Accident Reporting Procedures	
SOP HS-002 Bloodborne Pathogens		Changes to the HASP	
SOP HS-003 Container Management		Cold Stress	
SOP HS-004 Driver Safety		Confined Space	
SOP HS-005 Electrical Safety - Lockout/Tagout		Decon Procedures	
SOP HS-006 Excavation/Trenching		Exposure Guidelines	
SOP HS-007 General Safety		General PPE Usage	
SOP HS-008 Hand and Power Tools		Heat Stress	
SOP HS-009 Hazardous Substances Management		Hearing Conservation	
SOP HS-010 Inclement Weather		Lockout/Tagout	
SOP HS-011 Ladders		Personal Hygiene	
SOP HS-012 Noise Exposure		Respiratory Protection	
SOP HS-013 Nuclear Density Gauge		Review of Hazard Evaluation	
SOP HS-014 Utility Markout		Site Control	
SOP HS-015 Respirator Fit Test		Site Emergency Procedures	
SOP HS-016 Traffic Hazards		Slips, Trips, Falls	
SOP HS-017 Water Safety		Traffic Safety	
SOP HS-018 Working Around Heavy Equipment		Other (Specify):	
SOP HS-019 Rail Safety		Other (Specify):	
SOP HS-020 Aerial Lift		Other (Specify):	
SOP HS-021 Mobile Equipment		Other (Specify):	
SOP HS-022 Aquatic Ecological Survey/Electrofishing		Other (Specify):	
SOP HS-023 Scaffolding		Other (Specify):	
SOP HS-024 Wilderness Safety		Other (Specify):	
SOP HS-025 Manual Lifting		Other (Specify):	

Personnel Sign-in List	
Printed Name	**Signature**

Appendix E

GEI's Health and Safety SOPs

Final

STANDARD OPERATING PROCEDURES

SOP No. HS-001 Biological Hazards

1.1 Objective

The objective of this Standard Operating Procedure (SOP) is to prevent or limit the potential for GEI personnel to encounter biological hazards during field activities.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for contact with biological hazards such as animals, insects, plants, and sewage. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for encounters with biological hazards and the control methods to be implemented by GEI employees. These hazards must be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Mammals

During some site operations, animals such as stray or domesticated dogs or cats, raccoons, snakes, bears, rats, bats, etc. may be encountered. Employees should use discretion and attempt to avoid contact with animals. If these animals present a problem, efforts will be made to remove these animals from the site by contacting a licensed animal control technician.

1.3.1 Rabies

The rabies virus is transmitted through the bite of an infected animal or contact with saliva or brain/nervous system tissue of an infected animal. The rabies virus infects the central nervous system, causing disease in the brain. The early symptoms of rabies in people are fever, headache, and general weakness or discomfort. As the disease progresses, more specific symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation (increase in saliva), difficulty swallowing, and hydrophobia (fear of water). Death usually occurs within days of the onset of these symptoms.

If you are bitten or think you may be exposed, wash any wounds immediately and thoroughly with soap and water. Then go to the hospital emergency room and notify the Project Manager and the People Safety Team. The doctor, possibly in consultation with the state or local health department, will decide if you need a rabies vaccination. Decisions to start series of vaccinations will be based on your type of exposure and the animal you were exposed to, as well as laboratory and surveillance information for the geographic area where the exposure occurred. If possible have someone document what type of animal it was, how it was behaving prior to the bite, what caused it to bite the

employee, and if it's not a domestic animal that would be easy to find again in the future, try to get animal control on site to capture it. An Incident Report Form must be completed and submitted, per GEI's Incident reporting procedures. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

1.4 Insects and Arachnids

Insects, including bees, wasps, hornets, mosquitoes, ticks, spiders, etc., may be present at a job site making the chance of a bite/sting possible. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life-threatening condition. Some insect bites can transmit diseases such as Lyme disease or a virus such as West Nile. The following is a list of preventive measures:

- Apply insect repellent prior to performing field work and as often as needed throughout the work shift.
- Wear proper personal protective equipment (PPE), including protective clothing (work boots, socks, and light colored clothing).
- Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many insects are most active (between dawn and dusk).
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible.
- Field personnel who have or may have insect allergies must have insect allergy medication onsite and must inform the Site Safety Officer (SSO) and the People and Safety Team of their particular allergy prior to commencing work.
- Field personnel should perform a self-check at the end of the day for ticks.

1.4.1 Tick-borne Diseases

Lyme Disease

Lyme disease is caused by infection from a deer tick that carries a spirochete (a bacterium). During the painless tick bite, the spirochete may be transmitted into the bloodstream, often after feeding on the host for 12 to 24 hours. The ticks that cause the disease are often no bigger than a poppy seed or a comma in newsprint. The peak months for human infection are from May to September.

Symptoms appear in three stages. First symptoms usually appear from 2 days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick was attached. The rash is often bulls-eye like with red around the edges and clear in the center. The rash may be warm, itchy, tender, and/or "doughy." This rash appears in only 60 to 80 percent of infected persons. An infected

person also has flu-like symptoms of a stiff neck, chills, fever, sore throat, headache, fatigue, and joint pain. These symptoms often disappear after a few weeks.

The second stage symptoms, which occur weeks to months later include meningitis, severe headache, drooping of the muscles on the face, called Bell's Palsy, encephalitis, numbness, withdrawal, and lethargy. These symptoms may last for several weeks to several months. Third stage symptoms, which occur months or years later include arthritis, heart problems, and loss of memory. The third stage symptoms may mimic multiple sclerosis and Alzheimer's disease.

When in areas that could harbor deer ticks, employees should wear light color clothing, and visually check themselves and check and be checked by another employee when coming from wooded or vegetated areas. If a GEI employee has a tick bite, the People and Safety Team and Project Manager must be contacted immediately. The employee will be offered the option for medical treatment by a physician, which typically involves antibiotics. An Incident Report form must be completed in compliance with the Incident Reporting procedures. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

If personnel feel sick or have signs similar to those mentioned above, the SSO and the People and Safety Team must be notified immediately.



Figure 1: From left to right, the deer tick adult female, adult male, nymph, and larva on a centimeter scale.

How to Remove a Tick

A tick can be removed from the skin by pulling gently at the head with tweezers. If tweezers are not available, use tissue paper or cloth to grasp the tick. It is important to grasp the tick as close to the site of attachment and use a firm steady pull to remove it. Wash hands immediately after with soap and water. The affected area should also be washed with soap and water, then disinfected with an antiseptic wipe, if available. All mouth parts must be removed from the skin. If the tick was removed by breaking off the

mouth parts, an irritation or infection may occur because the organism that is causing the disease can still enter the body through the skin.

Treatment for Lyme Disease

Treatment with antibiotics is effective and recovery is usually complete. For first stage symptoms, antibiotics are usually given orally. However, treatment for second and third stage symptoms is prolonged and recovery may take longer. Antibiotic treatment is usually provided intravenously for second and third stage Lyme disease.

Babesiosis

The deer tick can also cause Babesiosis, an infection of the parasite Babesia Microti. Symptoms of Baesiosis may not be evident, but may also include fever, fatigue and hemolytic anemia lasting from several days to several months. Babesiosis is most commonly diagnosed in the elderly or in individuals whose immune systems are compromised. If there are no signs or symptoms of Babesiosis, usually no treatment it needed. If an employee believes they might have Babesiosis they'll see a physician to be tested. Treatment usually consists of taking prescription medications for 7 to 10 days.

Ehrlichiosis

Ehrlichiosis is a tick-borne disease which can be caused by either of two different organisms. Human monocytic ehrlichiosis (HME) is caused by *Ehrlichia chaffeensis*, which is transmitted by the lone star tick (*Amblyomma americanum*). Human granulocytic anaplasmosis (HGA), previously known as human granulocytic ehrlichiosis (HGE), is caused by *Anaplasma phagocytophilia*, which is transmitted by the deer tick (*Ixodes scapularis*).

Ehrlichiosis is transmitted by the bite of infected ticks, including the deer tick and the lone star tick. The symptoms of HME and HGE are the same and usually include fever, muscle aches, weakness and headache. Patients may also experience confusion, nausea, vomiting and joint pain. Unlike Lyme disease or Rocky Mountain spotted fever, a rash is not common. Infection usually produces mild to moderately severe illness, with high fever and headache, but may occasionally be life-threatening or even fatal. Symptoms appear 1 to 3 weeks after the bite of an infected tick. However, not every exposure results in infection. For those that become infected a drug called Doxcycline will be prescribed.

Rocky Mountain Spotted Fever

Rocky Mountain spotted fever is a tick-borne disease caused by a rickettsia (a microbe that differs somewhat from bacteria and virus). In the eastern United States, children are infected most frequently, while in the western United States, disease incidence is highest among adult males. Disease incidence is directly related to exposure to tick-infested habitats or to infested pets. Rocky Mountain spotted fever is characterized by a sudden onset of moderate to high fever (which can last for 2-3 weeks), severe headache, fatigue, deep muscle pain, chills and rash. The rash begins on the legs or arms, may include the

soles of the feet or palms of the hands and may spread rapidly to the trunk or rest of the body. Symptoms usually appear within 2 weeks of the bite of an infected tick. Like Ehrlichiosis the prescription drug Doxcycline is the first line treatment option.

1.4.2 Mosquito-Borne Disease

West Nile Virus
West Nile Virus is a mosquito-borne infection transmitted through the bite of an infected mosquito. The symptoms of West Nile Virus can be asymptomatic (no symptoms) or in more serious cases can lead to West Nile Fever. West Nile Fever can include fever, headache, tiredness, body ache, an occasional rash on the trunk of the body, and swollen lymph glands, In severe cases, people have developed West Nile Encephalitis or Meningitis which symptoms include fever, headache, neck stiffness, tremors, coma, and in some cases death. The incubation period for the disease is usually 2 to 15 days. The symptoms can range from a few days to several weeks. Most mosquitoes are not infected and the chance of infection from a mosquito bite of an on-site employee is very small.

1.5 Repellants

The following precautions will be used to help reduce the risk of mosquito bites:

Reduce mosquito-breeding areas by making sure wheelbarrows, buckets, and other containers are turned upside down when not used so that they do not collect standing water. According to the Environmental Protection Agency (EPA), many mosquitoes can breed in pooled water that's minimal enough to fill a bottle cap.

Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many mosquitoes are most active (between dawn and dusk).

Use mosquito repellant according to the manufacturer's directions when outdoors for long periods of time and when mosquitoes are most active.

Centers for Disease Control and Prevention (CDC) evaluation of information contained in peer-reviewed scientific literature and data available from the EPA has identified several EPA-registered products that provide repellent activity sufficient to help people avoid the bites of disease carrying mosquitoes. Products containing these active ingredients typically provide reasonably long-lasting protection:

- **DEET** (Chemical Name: N,N-diethyl-m-toluamide or N,N-diethly-3-methyl-benzamide)
- **Picaridin** (KBR 3023, Chemical Name: 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1-methylpropyl ester)

- **Oil of Lemon Eucalyptus** or **PMD** (Chemical Name: para-Menthane-3,8-diol) the synthesized version of oil of lemon eucalyptus
- **IR3535** (Chemical Name: 3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester)
- **Permethrin** (3-Phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate) **–** Permethrin kills ticks and can be used on clothing (but not skin)

The EPA characterizes the active ingredients DEET and Picaridin as "conventional repellents" and Oil of Lemon Eucalyptus, PMD, and IR3535 as "biopesticide repellents", which are derived from natural materials.

In general, higher concentrations of active ingredient provide longer duration of protection, regardless of the active ingredient, although concentrations above approximately 50 percent do not offer a marked increase in protection time. Products with less than 10 percent active ingredient may offer only limited protection, often from 1 to 2 hours. Products that offer sustained release or controlled release (micro-encapsulated) formulations, even with lower active ingredient concentrations, may provide longer protection times. Regardless of what product you use, if you start to get mosquito bites reapply the repellent according to the label instructions or remove yourself from the area with biting insects if possible.

Clothing and other products can be purchased pre-treated, or products can be treated using EPA-registered products. Permethrin is the only pesticide approved by the EPA for these uses. Permethrin binds tightly to the fabrics, resulting in little loss during washing and minimal transfer to the skin. Permethrin is poorly absorbed through the skin, although sunscreens and other products may increase the rate of skin absorption.

If you decide to use permethrin-treated clothing, consider these tips:

- Read the application instructions carefully and apply the product according to the label directions. Do not over-treat products.
- Permethrin treatments are only intended for use on fabrics; do not apply them directly to the skin or other items.
- Do not apply permethrin to clothing while it is being worn.
- Apply the product to clothing outdoors in well ventilated areas that are protected from wind.
- Hang treated fabrics outdoors and allow them to dry completely before wearing them.
- Wash permethrin treated clothing separately from other clothing items.

1.6 Poisonous Plants

The potential for contact with poisonous plants, such as poison ivy, oak, and sumac exists when performing fieldwork in wooded or boggy areas. Urushiol, an oily organic allergen found in plants, can cause an allergic reaction when in contact with the leaves or vines.

Poison ivy can be found as vines on tree trunks or as upright bushes. Poison ivy consists of three leaflets with notched edges. Two leaflets form a pair on opposite sides of the stalk, and the third leaflet stands by itself at the tip. Poison ivy is red in the early spring and turns shiny green later in the spring. Poison ivy grows throughout much of North America, including all states east of the Rocky Mountains. It is normally found in wooded areas, especially along edge areas where the tree line breaks and allows sunshine to filter through. It also grows in exposed rocky areas, open fields, and disturbed areas.

Poison oak can be present as a sparsely-branched shrub. Poison oak can grow anywhere in the United States with the exception of Hawaii, Alaska, and some southwest areas that have desert climates. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches.

Poison sumac can be present in the form of a flat-topped shrub or tree. It has fern-like leaves, which are velvety dark green on top and pale underneath. The branches of immature trees have a velvety “down.” Poison sumac has white, “hairy” berry clusters. Poison sumac grows exclusively in very wet or flooded soils, usually in swamps and peat bogs, in the eastern United States.



Poison Ivy

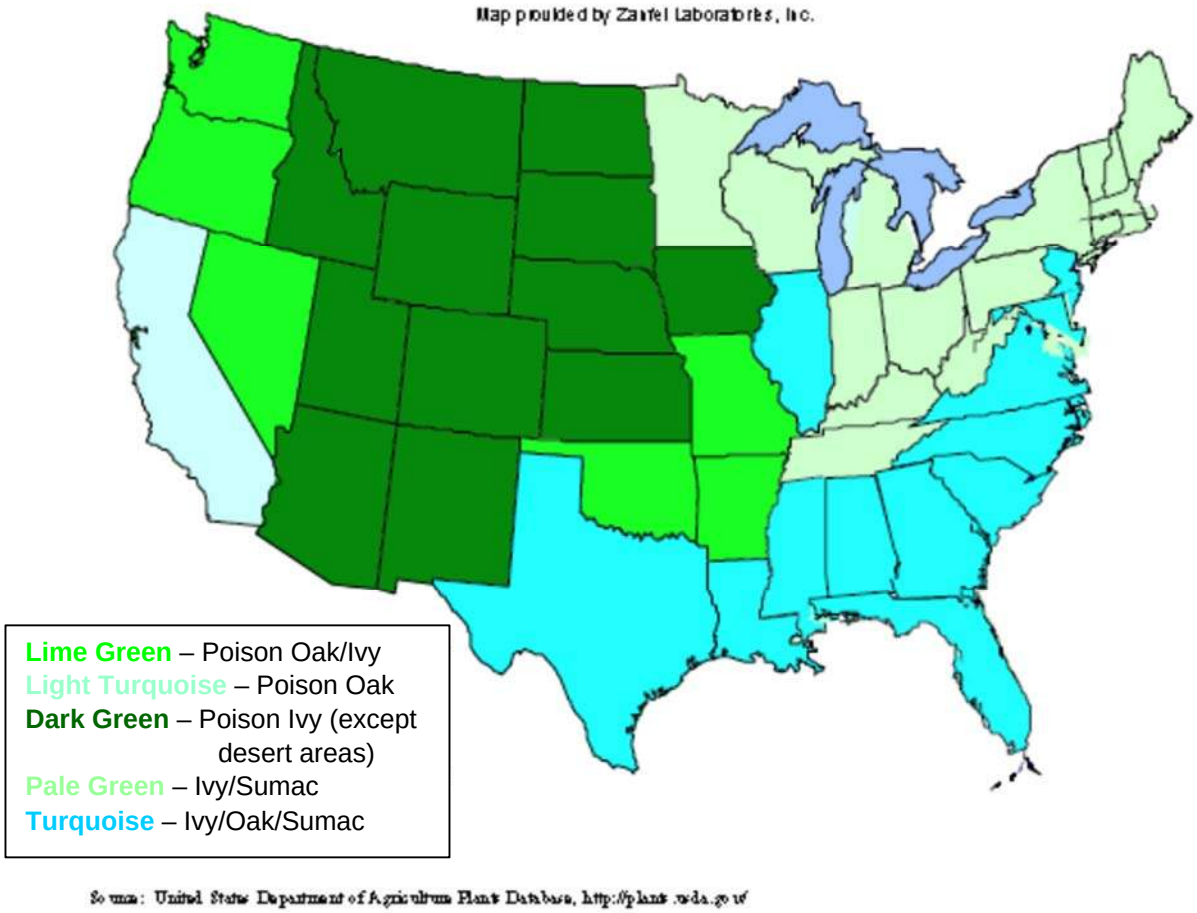


Poison Oak



Poison Sumac

U.S. Prevalence of Poison Ivy, Oak & Sumac



Source: United State Department of Agriculture Plant Database, http://plants.usda.gov/

To prevent exposure to these poisonous plants:

- Wear proper PPE, including long sleeves, long pants, boots, and gloves.
- Barrier skin creams, such as lotion containing bentoquatum (Tecnu®), may offer some protection prevent the occurrence of exposure symptoms.
- Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. Employees with known allergies should identify themselves to the SSO or Project Manager prior to starting field work as a precautionary measure. If you believe you have contacted one of these plants:
    - Immediately wash skin thoroughly with soap and water, taking care not to touch your face or other body parts.
    - Contact the People and Safety Team and Project Manager immediately after caring for affected skin.

  - Wash exposed clothing separately in hot water with detergent.

- After use, clean tools, and soles of boots with rubbing alcohol or soap and lots of water. Urushiol can remain active on the surface of objects for up to 5 years.
- If a rash occurs, contact the People and Safety Team and complete and submit an Incident Report Form. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

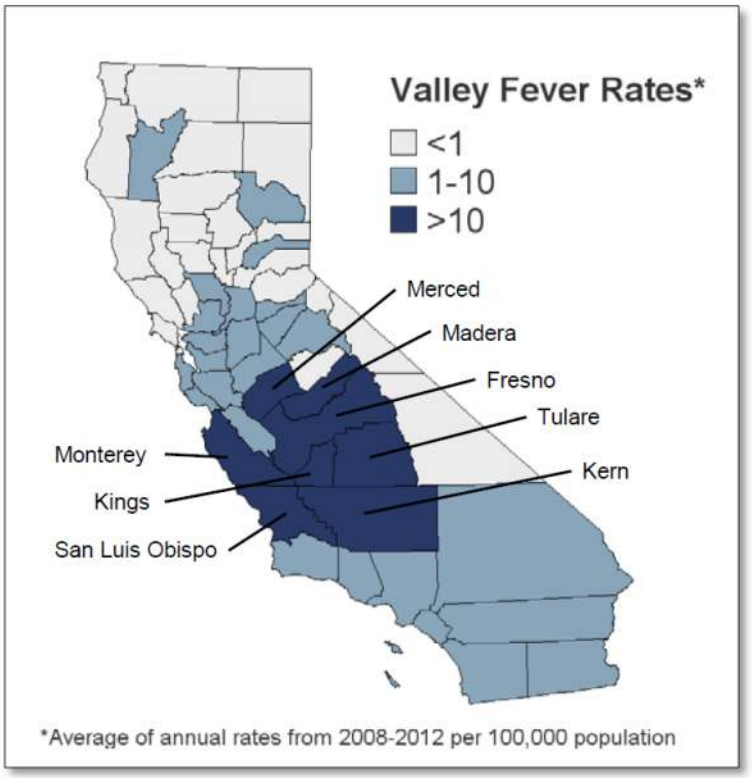
1.7 Sewage and Bacterial Impacted Sediments

Some project work may be conducted at sites that serve or have served as a combined sewer overflow and consequently may have received untreated sanitary sewage from numerous sources. Decomposed sewage can potentially be encountered within sites and their sediments. Sediments could contain soil and marine microorganisms, and bacterium associated with sewage. Many of these bacterium can cause illness through ingestion, direct contact, or the inhalation of a bio-aerosol possibly in the form of dust. Potential respiratory exposure to biological agents can also occur through the inhalation of aerosols produced during sediment handling activities. PPE as identified in the site-specific HASP will be worn to minimize potential exposures. Employees will follow the decontamination or disposal procedures identified in the HASP.

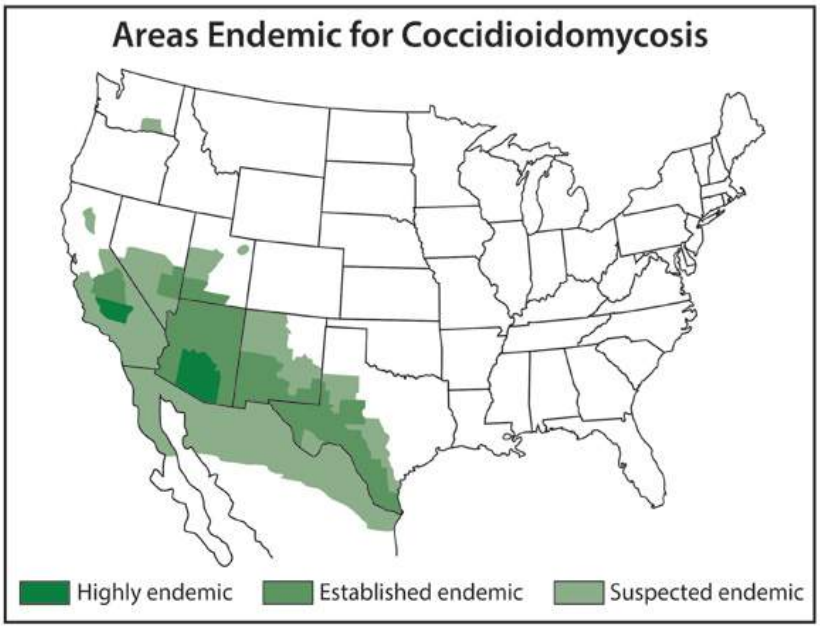
1.7.1 Fungal Spores in Soil – Valley Fever

Valley Fever is an illness that usually affects the lungs. It is caused by the fungus *Coccidioides immitis* that lives in the top 2 to 12 inches of soil in many parts of California. When fungal spores are present, any work activity that disturbs the soil, such as digging, grading, or other earth moving operations, or vehicle operation on dirt roads, can cause the spores to become airborne, therefore increasing the risk of Valley Fever. All employees on sites where the fungus is present, and who are exposed to dusty conditions and wind-blown dusts are at increased risk of becoming infected.

Valley Fever fungal spores are too small to be seen, and there is no reliable way to test the soil for spores before working in a particular place. Valley Fever can be found throughout the southwestern United States, parts of Mexico, and South America. Some California counties consistently have Valley Fever fungus present in the soil. In these regions Valley Fever is considered endemic. Health departments track the number of cases of Valley Fever illness that occur. This information is used to map illness rates as seen on the figures below from the Center of Disease Control Valley Fever Awareness website.



Rates of reported Valley Fever cases in California counties from 2008–2012. Darkest colored counties had the highest rates of Valley Fever.



When present, symptoms usually occur between 7 to 21 days after breathing in spores, and can include:

- Cough
- Fever
- Chest pain
- Headache
- Muscle aches
- Rash on upper trunk or extremities
- Joint pain in the knees or ankles
- Fatigue

Symptoms of Valley Fever can be mistaken for other diseases such as the flu (influenza) and TB (tuberculosis), so it is important for employees to obtain medical care for an accurate diagnosis and possible treatment.

While there is no vaccine to prevent Valley Fever, the following important steps must be taken in order to limit risk:

- Determine if the worksite is in an endemic area. Contact the local health department for more information about the risk in the county GEI is performing work that may disturb soils.
- Prepare work plans and work practices that reduce employee's exposure, which may include:
    - Provide air conditioned cabs with properly maintained dust filters for vehicles that generate heavy dust and make sure employees keep windows and vents closed.
    - Suspend work during heavy winds.
- When exposure to dust is unavoidable, National Institute for Occupational Safety and Health (NIOSH)-approved respiratory protection with particulate filters rated as N95, N99, N100, P100, or High Efficiency Particulate Air (HEPA) must be provided. The Project Manager must work with the Safety Team to develop and implement a respiratory protection program in accordance with California's Occupational Safety and Health Administration (Cal/OSHA's) Respiratory Protection standard (8 CCR 5144) for the project.
- Take measures to reduce transporting spores offsite, such as:
    - Clean tools, equipment, PPE, and vehicles before transporting offsite.
    - If employee's clothing is likely to be heavily contaminated with dust, provide coveralls and change rooms, and showers where possible.

1.8 Injury Reporting

If a GEI employee suffers an injury, bite, or sting on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.9 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.10 References

http://www.cdc.gov/ncidod/dvbid/westnile/index.htm
http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm
http://www.epa.gov/pesticides/health/mosquitoes/insectrp.htm
http://www.cdc.gov/niosh/topics/lyme/
Protecting Yourself from Ticks and Mosquitoes, NIOSH Fast Facts, Publication No. 2010-119
http://npic.orst.edu/pest/mosquito/ptc.html
http://www.cdc.gov/features/valley-fever-10-things/
https://www.cdph.ca.gov/HealthInfo/discond/Documents/VFGeneral.pdf
https://blog.epa.gov/blog/tag/mosquitoes/

1.11 Attachments

None

1.12 Contact

Health&SafetyTeam@geiconsultants.com

1.13 Review History

- June 2016
- June 2014
- November 2013
- October 2010

STANDARD OPERATING PROCEDURES

SOP No. HS-002 Infectious Materials and Bloodborne Pathogens Exposure Control Plan

1.1 Objective

GEI personnel may come in contact with potentially infectious agents (materials) when performing first aid or cardiopulmonary resuscitation (CPR). Employees may also come into contact with these agents when working at certain contaminated sites (i.e., urban sites, discarded contaminated needles, or sewer outfall exposures). This standard operating procedure (SOP) has been developed to minimize the potential for exposure to employees who may contact, directly or indirectly, infectious agents.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for contact with infectious materials and bloodborne pathogens. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for encounters with infectious materials or bloodborne pathogens and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

Universal Precautions (i.e., treat all potentially infectious materials as if it were infected) will be used by GEI employees.

1.3 Exposure Control Plan

1.3.1 Standard Procedures

Sampling of potentially infectious materials will be performed in a manner that minimizes the potential for creating splashes, droplets, or aerosols. Mechanical pipetting devices will be used for manipulating sanitary sewer effluent. Mouth pipetting is prohibited.

The use of glassware or equipment with sharp or pointed edges will be kept at a minimum to reduce the potential of injury that would create a direct route of entry into the body for infectious materials.

Minor cuts, scratches, or other breaks in the skin barrier will be covered prior to the handling of infectious materials. Employees experiencing exudative lesions or weeping dermatitis will refrain from direct contact with infectious materials.

Eating, drinking, smoking, or application of cosmetics is not permitted in areas where potentially infectious materials are handled or sampled.

Employees will wash and disinfect their hands, face, or other potentially contaminated skin surfaces upon completing the handling of infectious or potentially infectious agents or after rendering first aid.

1.3.2 Personal Protective Equipment

Personal Protective Equipment (PPE) will be worn to reduce the potential of exposures to splashes or aerosols. At a minimum, PPE will include safety glasses and appropriate gloves, but may also require the use of face, respiratory, foot, and full-body protection. Refer to the site-specific HASP for specific PPE requirements.

Disposable PPE used in the handling or sampling of infectious materials will be appropriately disposed of and not reused.

1.3.3 Medical Monitoring

Medical monitoring is required for an employee when a potential workplace exposure has occurred. The employee must follow the GEI Incident Reporting procedures regarding the potential exposure as soon as possible. For infectious agents in which a medically accepted vaccination has been developed (e.g., hepatitis B virus) (HBV) potentially exposed employees will be given the option to receive an inoculation at no cost. Employees who have been exposed will be given the option to receive a confidential medical evaluation also at no cost. Required records for exposed employees will be kept confidential.

1.3.4 Training

Employees with a reasonable risk for exposure must complete Bloodborne Pathogen training covering the following topics:

- An explanation of the Occupational Health and Safety Administration (OSHA) bloodborne pathogen standard.
- A general explanation of bloodborne diseases.
- An explanation of the modes of transmission of bloodborne diseases.
- An explanation of the GEI's Bloodborne Pathogen SOP and 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 bloodborne pathogens.
- Post-exposure procedures.
- An explanation of required signs and labels.

1.4 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health & Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.5 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.6 Attachment

None

1.7 Reference

OSHA 29 CFR 1910.1030 – Bloodborne Pathogens

1.8 Contact

Health&SafetyTeam@geiconsultants.com

1.9 Review History

- June 2016
- June 2014
- November 2013
- January 2011
- November 2010

STANDARD OPERATING PROCEDURES

SOP NO. HS-003 Container Management

1.1 Objective

This Standard Operating Procedure (SOP) has been developed to minimize the potential for injuries to GEI employees performing container and drum handling and sampling, through proper use of engineering and administrative controls, personal protective equipment (PPE), and education.

1.2 General

This SOP is intended for use by employees engaged in work with the management of containers that may contain hazardous substances or contaminated media. The site-specific health and safety plan (HASP) should include a hazard assessment and control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

Hazardous substances and contaminated media will be handled, transported, labeled, and disposed of in accordance with this paragraph. Drums and containers will meet the appropriate United States Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), and Environmental Protection Agency (EPA) regulations for the wastes that they contain.

Site operations will be organized to minimize the amount of drum or container movement. Prior to movement of drums or containers, employees exposed to the transfer operation will be notified of the potential hazards associated with the contents of the drums or containers. Unlabeled drums and containers will be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L, shall be on hand and ready for use to control incipient fires.

DOT specified salvage drums or containers and suitable quantities of proper absorbent will be kept available and used in areas where spills, leaks, or ruptures may occur. Where spills may occur, a spill containment program, which may be part of the HASP, will be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

1.3 Opening Drums and Containers

The following procedures will be followed in areas where drums or containers are being opened:

- Employees not actually involved in opening drums or containers will be kept a safe distance from the drums or containers being opened.
- If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation will be placed between the employee and the drums or containers being opened to protect the employee in case of accidental release.
- GEI employees will not handle or attempt to open bulging containers. Employees will not stand upon or work from drums or containers. GEI will contract with a hazardous waste company to handle, manage, and dispose of a bulging drum.

1.4 Material Handling Equipment

Several types of equipment can be used to move drums: (1) a drum grappler attached to a hydraulic excavator; (2) a small front-end loader, which can be either loaded manually or equipped with a bucket sling; (3) a rough terrain forklift; (4) a roller conveyor equipped with solid rollers; and (5) drum carts designed specifically for drum handling. GEI employees will not operate heavy equipment to move drums. This will be handled by an authorized subcontractor.

The following procedures can be used to maximize worker safety during drum handling and movement:

- Train personnel in proper lifting and moving techniques to prevent back injuries.
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface.
- Air condition the cabs of vehicles to increase operator efficiency; protect the operator with heavy splash shields.
- Supply operators with appropriate respiratory PPE when needed. Normally either a combination SCBA/SAR with the air tank fastened to the vehicle, or an airline respirator, and an escape SCBA are used because of the high potential hazards of drum handling. This improves operator efficiency and provides protection in case the operator must abandon the equipment.
- Have overpacks ready before any attempt is made to move drums.
- Before moving anything, determine the most appropriate sequence in which the various drums and other containers should be moved. For example, small

containers may have to be removed first to permit heavy equipment to enter and move the drums.

- Exercise extreme caution in handling drums that are not intact and tightly sealed.

- Ensure that operators have a clear view of the roadway when carrying drums. Where necessary, have ground workers available to guide the operator's motion.

1.5 Leaking, Open, and Deteriorated Drums

If a drum containing a liquid cannot be moved without rupture, immediately transfer its contents to a sound drum using a pump designed for transferring that liquid. Contract an approved vendor to immediately use an over pack container if the:

- Leaking drum contains sludge or semi-solids;

- Open drum contains liquid or solid waste;

- Deteriorated drum can be moved without rupture.

1.6 Radioactive Wastes

GEI does not routinely handle or manage radioactive waste. If required to do so for a project, procedures will be approved by the Corporate Health and Safety Officer (CHSO) and Regional Health and Safety Officer (RHSO).

1.7 Shock-Sensitive Wastes

GEI employees will not handle shock-sensitive waste. Shock-sensitive waste or chemicals may explode with friction, movement or heat. Some chemicals are shock-sensitive by nature-, others become shock-sensitive through drying, decomposition, or slow reactions with oxygen, nitrogen, or the container. Some chemicals that are, or can, become shock-sensitive will have that hazard noted in the safety data sheet (SDS).

- Drums and containers containing packaged laboratory wastes will be considered to contain shock-sensitive or explosive materials until they have been characterized. *Caution: Shipping of shock-sensitive wastes may be prohibited under U.S. Department of Transportation regulations. Shippers will refer to 49 CFR 173.21 and 173.50.*

1.8 Laboratory Waste Packs

It is unlikely that GEI employees work in an environment where laboratory waste packs are used. However if one is found, do not handle or open it. Complete the incident reporting form to identify finding the pack and then work with the Project Manager to find the appropriate means of disposal.

1.9 Sampling of Drum and Container Contents

Sampling of containers and drums will be done in accordance with a site-specific sampling plan that will be developed in conjunction with a site-specific HASP.

1.10 Staging Areas

Drums and containers will be identified and classified prior to packaging for shipment. Drum or container staging areas will be kept to a minimum number as approved by the client to safely identify and classify materials and prepare them for transport. Staging areas will be provided with adequate access and egress routes. Bulking of hazardous wastes will be permitted only after a thorough characterization of the materials has been completed and approved by the Client. GEI employees will not sign manifests unless a written authorization agreement is in place with the Client.

1.11 Shipment and Training

Shipment of materials to off-site treatment, storage, or disposal facilities involves the entry of waste hauling vehicles into the site. U.S. Department of Transportation (DOT) regulations (49 CFR Parts 171-178) and EPA regulations (40 CFR Part 263) for shipment of wastes must be complied with. Employees managing hazardous waste on behalf of a client must complete annual RCRA training and triannual DOT hazardous materials training. Training must be current and a manifest agreement with the client must be in place before employees can sign hazardous waste manifests on behalf of a client.

1.12 Tank and Vault Procedures

GEI employees do not routinely sample vaults and tanks. Entry procedures will be coordinated and approved by the CHSO and RHSO.

1.13 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health & Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the

potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.14 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection and appropriate training must be current

1.15 References

OSHA 1910.120 Hazardous Waste Operations and Emergency Response (j) Handling of Drums and Containers

1.16 Attachment

None.

1.17 Contact

Health&SafetyTeam@geiconsultants.com

1.18 Review History

- June 2016
- May 2014
- November 2013
- October 2011
- Initial Version Date Unknown

STANDARD OPERATING PROCEDURE
HS-004 Driver Safety

1.1 Objective

GEI has implemented a Safe Driving Program to encourage safe driving habits and promote the ongoing safety of our staff and the communities where we work. For more information, refer to the Operation of Vehicles section of GEI's Employee Handbook.

This Standard Operating Procedure (SOP) provides requirements and recommendations to minimize the potential risks while operating or riding in a motor vehicle.

1.2 General

GEI employees will adhere to the following requirements when operating a vehicle while conducting business on behalf of GEI. These requirements apply to GEI-owned, rental, and personal vehicles used to conduct GEI business:

- Employees must maintain a valid and current driver's license.
- Employees using a personal vehicle for work-related travel must have proper insurance coverage that meets the requirements in the state in which they reside.
- Employees must wear their safety belt while in a moving vehicle.
- Vehicle incidents will be reported in accordance with GEI's Incident Reporting procedures (*refer to* GEI's Safety App for smart phones or the Safety page on the GEI intranet.).
- Vehicles will be properly maintained and safely operated (*refer to* GEI's Fleet Maintenance Program).
- Employees will follow safe driving behaviors, which include limiting distractions such as manipulating radios or other equipment that may cause a distraction. Employees should not exceed the posted speed limit and should maintain a safe distance between other vehicles.
- When parking a vehicle at a job site, the employee should position the vehicle in a manner which reduces or eliminates the need to operate the vehicle in reverse. It is recommended, a safety cone should be placed at the rear of the vehicle after parking the vehicle and be removed prior to moving the vehicle. This precautionary measure makes the employee aware of other vehicles, equipment, and structures within the backup radius of the vehicle.

When driving an unfamiliar vehicle (rental or GEI-owned), it is the driver's responsibility to orient themselves to the vehicle by:

- Walking around the vehicle to observe the condition of the vehicle and hazards that could be within the travel path.
- Becoming familiar with the size of the vehicle.
- Note if the vehicle has anti-lock braking system (ABS[1]).
- Adjusting mirrors (rear and side).
- Adjust seats to be situated as far back as safely practical, away from the air bag, located in the steering wheel.
- Becoming familiar with dashboard, center console, and steering controls.
- Locating the turn signals, windshield wipers, lights, emergency flashers, and the heating, air conditioning, and defrost controls.

1.3 Driving Defensively

Driving defensively means not only taking responsibility for oneself and actions but also keeping an eye on "the other guy." Good defensive drivers may be able to anticipate what the other driver will do next. GEI recommends the following guidelines to help reduce risks while driving:

- Do not start the vehicle until each passenger and any belongings are secured in the vehicle.
- Remember that driving above or below the speed limit can increase the likelihood of a collision.
- Be aware of impaired drivers; if a car is straddling the center line, weaving, making wide turns, stopping abruptly, or responding slowly to traffic signals, the driver may be impaired or using a cellular telephone. Avoid an impaired driver by turning right at the nearest corner or exiting at the nearest exit.
    - If it appears that an oncoming car is crossing into your lane, pull over to the roadside, sound the horn, and flash the headlights.
    - If an unsafe or suspicious driver is observed, notify the police.
- Follow the rules of the road. Do not contest the "right of way" or try to race another car during a merge. Always be respectful of other motorists.

[1] ABS is a mechanism that allows the wheels on a vehicle to maintain contact with the surface of the road, based on inputs from the driver (braking), to prevent the wheels from locking up (ceasing rotation) and to avoid an uncontrolled skid.

- Allow large vehicles, including tractor trailers, extra breaking distance, turning radius, and avoid traveling in the other driver's blind spots.
- Do not follow too closely. GEI employees should use a minimum of "3-second following distance."
- While driving, be cautious, aware, and responsible.
- Use extra caution, observe road signs, and reduce speed in construction areas and school zones.
- Always be aware of pedestrians, bicyclists, and motorcyclists.

1.4 Cellular Phone Use and Other Distractions

Refer to the *Portable Communication Device Use While Driving* section of the GEI Employee Handbook for GEI's policy on the use of cellular telephones while operating a vehicle.

1.5 Drugs and Alcohol

The use of illegal drugs or alcohol is prohibited when driving a vehicle on GEI business. Be aware of the side effects of prescription and over-the-counter medications which can impair an employee's ability to drive.

1.6 Adverse Driving Conditions

When operating a vehicle, its possible adverse driving conditions may be encountered. Below is a list of possible conditions and how they can be mitigated.

1.6.1 Driving at Night

Vision maybe limited at night due to impairment of the driver's depth perception, color recognition, and peripheral vision. Another factor adding danger to night or early morning driving is fatigue. Drowsiness makes driving more difficult by dulling concentration and slowing reaction time. Effective measures to minimize these hazards by preparing the car and following guidelines:

- Check the headlights to ensure they are properly aimed. If you notice the headlights are not properly aimed, report it to the Branch Manager, or if applicable the rental car agent. Misaimed headlights blind other drivers and reduce the driver's ability to see the road.
- In addition to the known hazards of consuming alcohol prior to driving, night driving can potentially be affected because the recovery rate of glare from headlights is prolonged. Thus reducing your ability to see.

- Smoking in GEI vehicles and rentals is not permitted. When driving a personal vehicle for business, avoid smoking while driving. Nicotine and carbon monoxide may hamper night vision.
- Observe driving safety as soon as the sun goes down. Twilight is one of the most difficult times to drive, because the eyes' pupils are constantly changing to adapt to the growing darkness Always use headlights at dusk and at dawn; lights will not help the driver see better in early twilight, but they will make it easier for other drivers to see your car. Drive at a speed that allows you to see the road that is within the headlights span. Driving in a manner that prevents you from seeing hazards as they are illuminated is known as overdriving the headlights; it may be necessary for the driver to reduce speed to be prepared to brake within the illuminated area of the headlights.
- If an oncoming vehicle does not lower beams from high to low, avoid glare by watching the right edge of the road and using it as a steering guide.
- The driver should make frequent stops for light snacks and exercise. If the driver is too tired to drive, stop in a safe area and get some rest.

1.6.2 Snow/Freezing Conditions

When snow and ice are present, be prepared by following these winter driving safety tips.

1.6.2.1 Prepare the Vehicle Before a Snowstorm

- Check under the hood and take a look at the vehicles cooling system. Make sure the vehicle contains adequate antifreeze and the hoses are in good condition.
- Test heaters and defrosters ahead of time to make sure they are in good working condition.
- Test the windshield wipers and check the condition of the wiper blades. If wipers leave streaks on the windshields, replace the blades at the next possible opportunity. Keep the receipt to expense the cost with GEI or with the car rental company.
- It is recommended that a windshield washer/antifreeze solution is used during winter conditions.
- Check the lights on the vehicle and periodically clear them of snow and dirt.
- Vehicle batteries need extra power in cold conditions. Make sure the battery's terminals are clean and cables are secure.
- Determine if the vehicle has a anti-lock brake (ABS) system.
- Keep the gas tank at least half-full in the winter to help avoid gas line freeze up.

1.6.2.2 Driving During and After a Snowstorm

- Wear sunglasses to aid in limiting reflection from snow.
- Be aware of blind spots created by snow banks.
- Be extra cautious of pedestrians and other vehicles in intersections.
- Allow extra time for braking and increase the distance between your car and the car immediately in front of the car.
- Reduce speed and do not exceed the posted limit.
- If the tires starts to lose traction, remove the foot off the gas and gradually reduce speed. Accelerate slowly once traction is regained.
- If the vehicle starts to skid, and does not have anti-lock brakes, steer into the skid. This will bring the back end of the car in line with the front. Avoid using the brakes. If the vehicle does have anti-lock brakes, firmly brake as you steer into the skid.

1.6.3 Driving In the Rain

To prevent losing control of the car on wet pavement, take these preventive measures.

- Prevent skids by driving slowly and carefully, especially on curves.
- Steer and brake with a light touch.
- When necessary to stop or slow, do not brake hard or lock the wheels.
- Maintain mild pressure on the brake pedal.

Skidding
If the car begins to skid, ease the foot off the gas, and carefully steer the car in the direction you want the front of the car to go. For cars without anti-lock brakes, avoid using the brakes. This procedure, known as "steering into the skid," will bring the back end of the car in line with the front. If the car has anti-lock brake systems (ABS), brake firmly as you steer into the skid.

Hydroplaning
Hydroplaning happens when the water in front of the tires builds up faster than the car's weight can push it out of the way. The water pressure causes the car to lose contact with the road surface and slide on a thin layer of water between the tires and the road. At this point, the car can be completely out of contact with the road, making it possible for the driver to skid or drift out of the lane, or even off the road.

To avoid hydroplaning, keep the tires properly inflated and maintain good tread on the tires. If tires need to be replaced on a company vehicle, notify the branch manager or their designee. Slow down when roads are wet, and stay away from puddles. Try to drive in the tire tracks left by the cars in front of the vehicle. If the car begins to hydroplane, do not brake or turn suddenly. This could throw the car into a skid. Ease the foot off the gas until the car slows; accelerate slowly once traction is regained. If braking is needed, do so gently with light pumping actions. If the car has ABS, brake normally; the car's computer will mimic a pumping action, as necessary.

If weather conditions worsen to the point where the driver is not comfortable driving, pull the vehicle over to a safe location until conditions improve. Do not drive during severe weather conditions. Do not attempt to drive on roads with standing water or that have been flooded. Find an alternate route if these conditions exist.

1.6.4 Off Road

If operation of a vehicle is required off public or private roads or in situations where four-wheel-drive vehicles are required, the appropriate vehicle for the situation will be used.

Be sure any gear or equipment is secured inside the vehicle so it doesn't bounce around while the vehicle is off-road.

- Know the underside of the vehicle. Look under the vehicle and learn where the lowest-hanging parts are located so they are not damaged.
- Scout tricky terrain on foot. Don't hesitate to get out of the vehicle to examine, up close, the terrain and soil conditions. And be sure to scout out what's on the other side of a hill ahead of time so there are no surprises.
- Drive cautiously. Drive, "as slow as possible, as fast as necessary." Remember to use the gears to efficiently manage engine power, braking, and torque.
- Create a mental picture. Look ahead and visualize the paths to the vehicle will travel. Follow those paths.
- Drive straight up and down hills. Avoid diagonal lines that put the vehicle in a situation where it might roll.

1.7 Driver Training

GEI employees are required to complete driver safety training every 3 years. This training is managed by the People Team and will be assigned through GEI's e-learning provider.

1.8 Injury Reporting

GEI employees will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, chemical spills, vehicle accidents, and property damage. The following steps must be followed when an incident occurs:

1. In life-threatening situations, immediately call 9-1-1.
2. Stop work activity to address any injury, illness, property damage, spill or other emergency.
3. **Immediately** report any incidents to your Supervisor/Project Manager and Regional Health & Safety Officer.
4. If your injury or illness is not life-threatening, call Medcor Triage at 1-800-775-5866 to speak with a medical professional.
5. Complete an Incident Report Form **immediately** after addressing the incident. Report forms are available on GEI's Safety App (for smart phones) and on the Safety page on the GEI intranet.

For vehicle accidents involving another vehicle or damage to property, the employee will take pictures of each vehicle or property involved in the incident and obtain a police report. In some municipalities police will not be dispatched to a non-injury accident, but every effort needs to be made to try and obtain the report.

1.8.1 Injury Triage Service

If a GEI employee experiences a work-related injury that is not life-threatening, the employee will initiate a call to Medcor Triage at 1-800-775-5866. The injured employee will detail any medical symptoms or complaints which will be evaluated by a Registered Nurse (RN) specially trained to perform telephonic triage. The RN will recommend first aid self-treatment or refer the injured employee for an off-site medical evaluation by a health professional at a clinic within GEI's workers compensation provider network. GEI employees are still required to follow our Accident Reporting procedures as listed above.

1.9 Limitations

Follow safety procedures as defined in the site-specific HASP.

1.10 References

National Safety Council
Oklahoma Safety Council
GEI Consultants, Inc. Employee Handbook

1.11 Attachments

None

1.12 Contact

SafetyTeam@geiconsultants.com

1.13 Review History

- December 2017
- November 2016
- May 2014
- November 2013
- January 2011

STANDARD OPERATING PROCEDURES

HS-005a Electrical Safety

1.1 Objective

Electrical hazards are typically the most serious physical hazards GEI employees encounter when working on or near an electric substation, conducting intrusive activities such as excavation or drilling, using powered hand tools, or working near overhead utilities. This Standard Operating Procedure (SOP) has been developed to minimize the potential for exposure to energized electrical equipment while performing work activities.

1.2 General

Employees who face a risk of electric shock will be trained and become familiar with electrically-related safety practices in the GEI annual Health and Safety training. This training will include safety-related work practices that pertain to their respective job assignments and minimum approach distances.

An activity hazard analysis conducted for the project scope of work will evaluate the potential for electrical shock and be incorporated in the site-specific health and safety plan (HASP). In addition, site-specific training will be conducted by the Project Manager or their designee to discuss the project electrical hazards and include a review of the HASP requirements.

Annual health and safety training will include review of this electrical safety SOP and GEI's lockout/tagout requirements. Retraining will be required when there is a change in job assignments; a change in the energy control procedures; or a new hazard is introduced. Retraining may also be conducted through the Project Safety Briefing and documented on the Project Safety Briefing form.

Safe work practices will be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment or circuits that are or may be energized. Employees may not enter spaces containing exposed energized parts unless proper illumination, protective shields, protective barriers, or insulating materials (if necessary) are provided to enable employees to work safely. If portable ladders are needed near electrical equipment, they will have non-conductive side rails.

1.3 Personal Protection

Measures to mitigate exposure to overhead and subsurface electrical transmission and distribution lines should be adhered to at all times when working adjacent to electrical hazards. These measures include:

- Electrical Hazard (EH)-rated footwear and hardhat are required when working onsite. Additional personal protective equipment (PPE) may be needed as referenced in the site specific HASP.
- Avoid carrying tools/equipment above waist height if overhead electric hazards exist.
- Maintain the minimum approach distance (MAD) from bus bars, transformer/capacitor electrodes, and overhead transmission/distribution lines.
- Stop work immediately and vacate the work area in the event lightning is observed.

Measures of protection that should be adhered to within an active substation perimeter or if work adjacent to the substation perimeter consists of intrusive activities:

- Contact utility clearance agency at least 48 hours prior to any invasive activities for mark out of underground public utilities.
- Obtain the most recent as-built drawings of the transmission/distribution line layout from the client.
- Mark out of underground transmission/distribution lines by the client survey/mark out personnel if applicable.
- Conduct work under the supervision of the client's Health and Safety representative per client requirements.
- Conductive items such as jewelry or clothing containing metals will not be worn unless they are rendered non-conductive by insulating means such as covering or wrapping with materials that specifically rated as non-conductive, or other insulating means.
- Use hand digging tools specifically designed for use on substation property (i.e., insulated digging bar, long-handled spoon shovel, etc.). In addition, rubber gloves and fire-resistant clothing are required if hand digging in a substation.
- Use insulated lineman's gloves when handling equipment that may come into contact with electrical utilities.
- EH-rated footwear is required when working onsite.
- Flame resistant clothing that meets National Fire Protection Association (NFPA) 70E standards is to be worn.

- Avoid carrying tools/equipment above waist height if overhead electric hazards exist.
- Ground vehicles or equipment **within the substation perimeter** using 4-aught gauge grounding cable. Adhere to specific client or site requirement for grounding.
- Maintain a minimum clearances on substations in accordance with 29 CFR 1910.333 and NFPA 70E standards when working near energized equipment.
- Maintain a minimum offset of 3 feet from marked underground transmission/distribution lines.
- Avoid working within or outside of a substations in conditions of high humidity, rain, or thunderstorms.
- Stop work immediately and vacate the work area in the event lightning is observed.

1.3.1 Minimum Approach Distance

According to OSHA, the MAD is "…the closest distance an employee is permitted to approach an energized or grounded object." MADs ensure that employees do not approach or take any conductive object closer to energized equipment than the allowed distances. All GEI employees conducting work onsite must follow the MADs shown below:

Nominal Voltage in Kilovolts	Minimum Approach Distance: Phase to Ground Exposure
0.05 to 1.0	Avoid Contact
1.1 to 15.0	2'1"
15.1 to 36.0	2'4"
36.1 to 46.0	2'7"
46.1 to 72.5	3'
72.6 to 121	3'2"
138 to 145	3'7"
161 to 169	4'
230 to 242	5'3"
345 to 362	8'6"
500 to 550	11'3"
764 to 800	14'11"

Reference: Table R-6 in OSHA regulation CFR 1910.269 (l) (10)

Unqualified employees must maintain a 10-foot distance from all electrical sources. Vehicular and mechanical equipment will also maintain minimum clearance distances of 10 feet.

Site personnel will assume that all electrical equipment at surface, subsurface, and overhead locations are energized until the equipment has been designated as de-energized by a client representative. Client representatives will be responsible for de-energizing and lockout/tagout of all electrical equipment. If the equipment cannot be de-energized, work will stop and the GEI Field Representative and/or the Site Safety Officer (SSO) will consult with the Project Manager and CHSO. GEI will notify the client prior to working adjacent to this equipment, and will verify that the equipment is energized or de-energized in the vicinity of the project area.

All power lines that have been indicated by the client to be de-energized must be locked out by the client or their representative, such that the lines cannot be energized when personnel are working near them. The lines will not be unlocked and re-energized until GEI notifies the client that they have completed work in the area and that all personnel are clear of the area. The client representatives will thoroughly familiarize GEI personnel with site-specific lockout/tagout procedures during the site orientation. Conductors and parts of electrical equipment that have been de-energized, but not been locked or tagged out, shall be treated as live/energized. Only qualified persons may work on electric circuit parts or equipment that has not been de-energized. Such persons will be made familiar with the use of special precautionary techniques, PPE, insulating and shielding materials, and insulated tools.

If power lines cannot be de-energized, the SSO will consult with the client to discuss how to proceed. Work tasks will only commence after determining that a safe working distance (MAD) can be maintained and all personnel working in the area have been informed of the limitation. All work performed within the substation boundaries requires the use of task-specific PPE as described in the HASP.

GEI will verify that the contractor or subcontractor has located and marked all electric, gas, water, steam, sewer, and other utility service lines before any intrusive work is started. In each case, any utility company that is involved should be notified in advance by the contractor, and its approval or services will be obtained, if necessary.

1.3.2 Ground-Fault Circuit Interrupters (GFCI)

GEI employees will use approved ground-fault circuit interrupters for personnel protection when using electrical tools and equipment. Equipment will be plugged into receptacles protected by a GFCI, extension cords with built-in GFCIs, or a GFCI adapter is to be used.

1.3.3 Equipment Inspection

Each extension cord, plug and receptacle, and any equipment connected by the cord and plug, will be visually inspected before each day's use for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal damage. Each receptacle and plug will be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor will be connected to its proper terminal.

Inspection of equipment will be performed before first use; before equipment is returned to service following any repairs; before equipment is used after any incident which can be reasonably suspected to have caused damage (e.g., when an extension cord is run over), and at intervals not to exceed 3 months. Cords and receptacles which are fixed and not exposed to damage will be tested at intervals not exceeding 6 months. Equipment found damaged or defective will not be used and will be properly tagged as "Out of Service"; notify the Branch Manager so that the equipment can be replaced or repaired. If the equipment cannot be repaired it will be disposed of properly.

1.4 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or supervisor/project manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health & Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.5 Limitations

- Follow safety procedures as defined in the site-specific HASP at all times.
- If lockout/tagout procedures are going to be performed by GEI employees or GEI subcontractors, the specific procedure will be reviewed with the CHSO and the RHSO.

1.6 References

OSHA 29 CFR 1910.147 Appendix A – The control of hazardous energy (lockout/tagout)

1.7 Attachments

None

1.8 Contact

Health&Safetyteam@geiconsultants.com

1.9 Review History

- February 2017
- May 2014
- October 2011
- August 2010 (Titled Lock Out/Tag Out)

STANDARD OPERATING PROCEDURES

SOP No. HS-006 Excavations and Trenches

1.1 Objective

The objective of this Standard Operating Procedure (SOP) is to highlight the hazards and safety procedures when work activities include excavations and/or trenches. The following guidelines will be followed when excavations or trenches are present on GEI projects.

1.2 General

This SOP is intended for use by employees engaged in work on project sites that include trenching and/or excavation operations. The site-specific health and safety plan (HASP) must include a hazard assessment for the project that identifies the potential for trenching and excavation hazards and the control methods to be implemented by GEI employees. These hazards must be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

An "excavation" is any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

A "trench" (trench excavation) is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

Do not enter a trench or excavation without consulting with the Project Manager, Corporate Health and Safety Officer (CHSO), or Regional Health and Safety Officer (RHSO).

1.2.1 Personal Protective Equipment

Employees will be provided with the personal protective equipment (PPE) necessary to help protect them from the hazards of work activities related to excavations and/or trenches. All employees will wear a hard hat, steel toe or composite toe boots, and safety glasses at a minimum. In addition, face shields, gloves, fall protection and hearing protection may be required. PPE must be maintained in good condition, kept clean and properly stored when not in use. More information regarding PPE is located in Section 6 of GEI's Corporate Health and Safety Program.

1.3 Hazards

Hazards associated with excavations and trenches can include collapse, falls, falling objects, hazardous atmospheres, and incidents involving mobile equipment. One cubic yard of soil can weigh as much as a car.

1.4 Entry

GEI employees will not enter trenches or excavations that do not comply with OSHA 29 CFR 1926.650. If a project requires GEI employees to enter a trench or excavation, the trench or excavation must meet the following requirements described in the following sections.

Do not enter a trench or excavation without consulting with the Project Manager, Corporate Health and Safety Officer (CHSO), or Regional Health and Safety Officer (RHSO).

1.4.1 Competent Person

The excavation must be inspected prior to the start of each shift by a competent person who most likely will work for the contactor performing the work. The competent person is an individual who is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to workers, soil types and protective systems required, and who is authorized to take prompt corrective measures to eliminate these hazards and conditions. GEI generally does not act as the competent person.

1.4.2 Soil Type

The competent person for the project will determine what the soil type is and what type of protective system will be implemented. The type of soil where the excavation or trench is being dug has significant influence on what type of protective system will need to be in place. There are four types of soil: stable rock, type A, type B, and type C. As you progress from stable rock to type C, the cohesive properties of the soil change the soil becomes less stable.

1.4.3 Protective System

A protective system is required for trenches or excavations greater than 5 feet in depth unless the excavation is made entirely in stable rock. In special situations the competent person may require a protection system for an excavation that is less than 5 feet deep. The competent person is responsible for assessing the soil type and the protective systems required for a specific trench when an excavation is less than 20 feet deep. If the excavation is greater than 20 feet in depth, the protection system requires a design by a registered professional engineer or based on tabulated data prepared and/or approved by a registered professional engineer.

The protective system will be designed based on soil type, depth of excavation, water level, loads adjacent to the excavation, changes in weather conditions, or other operations in the area. Protective systems can include sloping or benching of the sidewalls, shoring the sidewalls using an approved support system, or shielding workers with a trench box or other similar type of support.

The different types of protective systems include:

Benching is a method of protecting workers from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near vertical surfaces between levels. Benching cannot be done with Type C soil.

Sloping involves cutting back the trench wall at an angle inclined away from the excavation.

Shoring requires installing aluminum hydraulic or other types of support structures to prevent soil movement and cave-ins.

Shielding protects workers by using trench boxes or other types of supports to prevent soil cave-ins.

Designing a protective system can be complex because many factors must be considered: soil classification, depth of cut, water content of soil, changes caused by weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench) and other operations in the vicinity.

1.4.4 Access and Egress

Excavations and trenches greater than 4 feet in depth require a safe access and egress including ladders, steps, or ramps. These points of access and egress are to be no greater than 25 feet of lateral travel in any direction.

1.4.5 Atmospheric Hazards

Where oxygen deficiency (atmospheres containing less than 20.7% oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation will be tested before employees enter excavation.

1.5 Subcontractor Oversight

When GEI is overseeing excavation activities performed by a subcontractor, the following safety hazards should be monitored:

- Care must be taken not to create new hazards like narrow walkways along edges of an excavation.
- Heavy equipment must not be parked or working at the edge of the excavation.
- Spoils should not be stockpiled within 2 feet of the trench edges.
- Confirm with subcontractor that underground utilities have been located before any excavation or trenching activities begin (*refer to* SOP HS-014 Utility Mark-out).
- Confirm with the subcontractor that the excavation or trench has been tested for hazardous atmospheres before entering.
- Confirm with the subcontractor that the excavation or trench has been inspected by a competent person before each work shift and after any type of precipitation. If hazards are identified during this inspection, verify that the hazards are controlled prior to entering the trench or excavation.
- GEI employees will not work under raised or suspended loads.
- Excavations/trenches must be protected at the end of a work shift if they are to be left open. These trenches/excavations must be covered and a sign that reads "Hole" must be placed in a location that will notify anyone of the hazard. Or a secure barricade will need to be installed.

In circumstances where GEI employees are working on sites where a contractual agreement with the excavation contractor does not exist and we cannot confirm the above stated conditions, entry into trenches or excavations will not be conducted. Any safety concerns that arise should be communicated to the Project Manager and, if necessary, the client.

1.6 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened.

The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.7 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

Some states, including Massachusetts, require a trench permit prior to trenching or excavation activities. Verification of local requirements will be evaluated in the planning stage.

1.8 References

OSHA 29 CFR 1926.650 – Subpart P; *Excavations*
OSHA Construction eTool – http://www.osha.gov/SLTC/etools/construction/index.html
OSHA FactSheet Trenching and Excavation Safety – viewed on 9/13/2016
https://www.osha.gov/OshDoc/data_Hurricane_Facts/trench_excavation_fs.pdf

1.9 Attachments

None

1.10 Contact

Health&SafetyTeam@geiconsultants.com

1.11 Review History

- September 2016
- May 2014
- November 2013
- January 2011
- Initial Version Date Unknown

STANDARD OPERATING PROCEDURES

SOP No. HS-008a Non-Powered Hand Tools

1.1 Objective

This Standard Operating Procedure (SOP) is intended for use by employees working with non-powered hand tools. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the hazards associated with the non-powered hand tools that will be used. These hazards should be reviewed during the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.2 General

Misuse of hand tools accounts for the majority of accidents and injuries involving hand tools. Only use a tool for the task which it was designed for. If the right tool isn't available contact the Project Manager and discuss what is needed. Improper maintenance is another leading cause of injuries. Employees using hand tools may be exposed to a number of other potentially serious hazards: falling objects (i.e., objects can fall as a result of contact with tools or objects which are abrasive or splash), harmful dust, fumes mists, vapors, and gases, as well as contact with electrical power sources.

1.2.1 Condition of Tools

All hand tools, whether furnished by GEI or the employee, will be maintained in safe working condition. All hand tools must be inspected before use. Never use a tool if its handle has splinters, burrs, cracks, splits or if the head of the tool is loose. Never use impact tools such as hammers, chisels, punches or steel stakes having mushroomed (flattened) heads. Tag worn, damaged or defective tools "Out of Service" and do not use them; notify your Branch Manager or Project Manager so that the tool can be replaced or repaired. If the tools cannot be repaired they will be disposed of properly. GEI does not issue or permit the use of unsafe hand tools.

1.2.2 Personal Protective Equipment

Employees using hand tools will be provided with the personal protective equipment (PPE) necessary to protect them from the hazard of the tool as well as the associated hazards with using the tool. (i.e., projectile debris, dust, etc.). <u>All employees will wear work gloves, steel toe or composite toe boots, and safety glasses at a minimum</u>. In addition, face shields and hearing protection may be required. Most hand injures can be avoided with the proper use of PPE. PPE must be maintained in good condition, kept clean and properly stored when not in use. More information regarding PPE is located in Section 6 of GEI's Corporate Health and Safety Program.

1.2.3 General Safe Practices

Never wear sandals, open-toed or canvas shoes when working with tools. Always tie back long hair. Avoid loose-fitting clothes which might become entangled in a tool. Always remove rings and other jewelry. Make sure your grip and footing are secure when using large tools. Never carry tools up ladders; use a tool belt, hoist, or a rope. Use extra caution when using tools at heights – a falling tool could kill a co-worker. Always pass a tool to another person by the handle – never toss it to them. Never use a tool with hands are wet, oily, or greasy. Select ergonomically-designed tools for work tasks when movements are repetitive and forceful. Always make sure observers are at a safe distance. Always secure work with a vice, clamp, or other support.

1.3 Non-Power Hand Tools

Non-powered hand tools include anything from axes to wrenches. Even though the tool is powered by human inertia, injuries from improper use of non-powered hand tools often involve severe disabilities.

1.3.1 Knives

Only use a knife with a sharpened blade. Pull the knife through the object and away from your body; pulling motions are easier to manage. Never use a knife if its handle has splinters, burrs, cracks, splits or if the blade is loose. Knives should never be used as screwdrivers, pry bars, or can openers. Never pick up knives by their blades. Always carry knives with their tips/points toward the floor. Never carry knives, scissors, or other sharp tools in pockets. Never attempt to catch a falling knife. When not in use, knives should be stored in sheaths. Box cutters will be self-retracting.

1.3.2 Wrenches

Never use wrenches that are bent, cracked, badly chipped, or having loose or broken handles. Discard any wrench with spread or battered jaws; if the handle is bent; or if a wrench has broken or battered points and notify your Branch Manager so that a replacement can be made. Never slip a pipe over a single head wrench handle to increase leverage. Never use a shim to make a wrench fit. Pull on a wrench using a slow, steady motion. Do not use push force on a wrench; you could lose your balance if the wrench slips.

1.3.3 Screwdrivers

Always match the size and type of screwdriver blade to fit the head of the screw. Do not hold the work piece against your body while using a screwdriver. Never put your fingers near the tip of a screwdriver when tightening a screw. Never use a screwdriver to make a starting hole for screws. Never use a screwdriver as a chisel, pry bar, or nail puller. When performing electrical work, always use an insulated screwdriver. Never use a screwdriver to test the charge of a battery.

1.3.4 Hammers

Never use a hammer if your hands are oily, greasy or wet. Always check behind you before swinging a hammer. Use a claw hammer for pulling nails. Never strike nails or other objects with the "cheek" of the hammer. Do not strike a hardened steel surface, such as a cold chisel, with a claw hammer. Never strike one hammer against another hammer. Never use a hammer as a wedge or a pry bar.

1.3.5 Pliers

Never use pliers which are cracked, broken, or sprung. Never use pliers as a wrench or a hammer. Do not attempt to force pliers by using a hammer on them. Never slip a pipe over the handles of pliers to increase leverage. When performing electrical work, always use insulated pliers. When using diagonal cutting pliers, shield loose pieces of cut material from flying into the air by using a cloth or your gloved hand.

1.3.6 Snips

Never use snips as a hammer, screwdriver, or pry bar. Always wear safety glasses or safety goggles when using snips to cut materials. Always wear work gloves when cutting materials with snips. Keep the blade aligned by tightening the nut and bolt of the snips. Never use straight cut snips to cut curves. Always use the locking clip on the snips when you have finished using them. Never leave or store snips in the open position.

1.3.7 Hand Saws

Always keep handsaws sharp and free of rust to prevent them from binding or jumping. Never carry a saw by the blade. Always hold the work piece firmly against a work table. Keep control of saws by releasing downward pressure at the end of the stroke. Never use an adjustable blade saw such as a hacksaw, coping saw, keyhole saw, or bow saw, if the blade is not taut. Oil saw blades after each use. Never force the saw through the cut as this may cause the saw to buckle or fly out of the groove and cause injury.

1.3.8 Chisels

Only use sharpened chisels. Never use chisels having mushroomed (flattened) striking heads. Whenever possible, hold a chisel by using a tool holder. Clamp small work pieces in a vise and chip towards the stationary jaw of the vise. Chip or cut away from yourself and keep both hands in back of the cutting edge. Always wear safety glasses or a face shield.

1.3.9 Vise and Clamps

Never use a vise having worn or broken jaw inserts, or having cracks or fractures in the body of the vise. Position the work piece in the vise so the entire face of the jaw supports the work piece. When clamping a long work piece in a vise, support the far end of the work piece by using an adjustable pipe stand or saw horse. Never slip a pipe over the handle of a vise to increase leverage. Never use a C-clamp for hoisting materials. Never use a C-clamp as a permanent fastening device.

1.3.10 Jacks

A manufacture's rated capacity must be clearly marked on all jacks and all jacks must have a stop indicator. When using a jack, never exceed the capacity of the stop indicator. Jacks should be lubricated and inspected regularly. When setting up a jack, ensure the base is centered on a firm, level surface. The jack head should also be placed against a level surface. Lift force should be applied evenly. Put a block under the base of the jack when the foundation is not firm. If it seems likely the cap could slip, place a block between the jack cap and load. Immediately block the load after it is lifted.

1.4 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or supervisor/project manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health & Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.5 Limitations

Follow safety procedures as defined in the site-specific HASP or in the manufacturer's specifications. Appropriate PPE must be worn correctly to provide the intended level of protection. If a hand tool is being used that is not identified in this SOP consult the manufacturer's literature and contact the Safety Team so we can include the information in a future version of this SOP.

1.6 References

OSHA Standards for the Construction Industry, Subpart I
Risk Analytics, LLC Hand Tools Training, 2006

1.7 Attachments

None

1.8 Contact

Health&SafetyTeam@geiconsultants.com

1.9 Review History

- July 2016
- May 2014
- August 2011
- October 2010
- One revision date unable to be found

STANDARD OPERATING PROCEDURES

SOP NO. HS-009 Hazardous Substances Exposure Management

1.1 Objective

This Standard Operating Procedure (SOP) is intended to outline the steps GEI employees will take to identify potential hazards associated with exposure to hazardous substances, the risks associated with these hazards, and the proper controls to use to minimize exposure. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential of encountering a hazardous substance and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.2 General

A hazardous substance is any substance that has one or more of the following intrinsic properties:

- Explosiveness
- Flammability
- Ability to oxidize
- Human toxicity (acute or chronic)
- Corrosiveness (to human tissue or metal)
- Ecotoxicity (with or without bioaccumulation)
- Capacity, on contact with air or water, to develop one or more of the above properties

1.3 Hazard Identification

An initial identification of hazards should be done based on a review of available documents including lists of chemicals used on site, analytical data from soil, surface water, groundwater, air, spill history, site history, equipment on site, maps, photos, and a preliminary survey.

Once hazardous substances are identified the regulated exposure limits need to be identified. Each substance may have a state/federal exposure value for each of the following (if applicable):

Action Level – An airborne level, typically one-half of the permissible exposure limit (PEL) designated in Occupational Safety and Health Administration's (OSHA's) substance-specific standards, 29 CFR 1910, Subpart Z, calculated as an

8-hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Ceiling Limit – The exposure limit a worker's exposure may never exceed.

Sampling and Analytical Error – A statistical estimate of the uncertainty associated with a given exposure measurement.

Short-Term Exposure Limit (STEL) – The average exposure to a contaminant to which a worker may be exposed during a short time period (typically 15-30 minutes).

Time Weighted Average (TWA) – The average exposure to a contaminant over a given period of time, typically 8 hours.

1.4 Risk Identification

Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances will be identified. GEI employees and GEI subcontractors who will be working on the site will be informed of risks that have been identified.

Risks to consider include, but are not limited to:

- Potential exposures exceeding the permissible exposure limits and published exposure levels
- Potential Immediately Dangerous to Life and Health (IDLH) concentrations
- Potential skin absorption and irritation sources
- Potential eye irritation sources
- Potential hazardous atmospheres, including oxygen deficiency and fire and explosion hazards

1.5 Engineering Controls, Work Practices, and Personal Protective Equipment for Employee Protection

Engineering controls, work practices, and personnel protective equipment (PPE) for substances regulated in OSHA Subpart G (Occupational Health and Environmental Control) and Subpart Z (Toxic and Hazardous Substances) will be implemented in to protect employees from exposure to hazardous substances and safety and health hazards.

1.5.1 Elimination/Substitution

The first control method should be to try and eliminate or substitute the hazards with a safer alternative. This is the most effective solution as shown is Figure 1 below. If you can remove the hazard than you no longer need to find a way to protect the employee

from it. Or you can substitute a different piece of equipment or chemical to use that doesn't pose the same hazard and doesn't create a new one.

1.5.2 Engineering Controls

Engineering controls implement physical change to the workplace, which eliminates/reduces the hazard on the job/task. Examples include:

- Change the process to minimize contact with hazardous chemicals
- Isolate or enclose the process
- Use of wet methods to reduce generation of dusts or other particulates
- General dilution ventilation
- Use of fume hoods

1.5.3 Administrative Controls (Work Practices)

Administrative controls establish efficient processes or procedures to help protect the employee. Examples of these are:

- Rotate job assignments
- Adjust work schedules so that workers are not overexposed to a hazardous chemical

1.5.4 Personal Protective Equipment

The use of PPE to reduce exposure to risk factors is the last line of defense. All other options should be exhausted before use of PPE. Examples of PPE are:

- Chemical protective clothing
- Respiratory protection
- Gloves
- Eye or hearing protection
- Steel toe boots

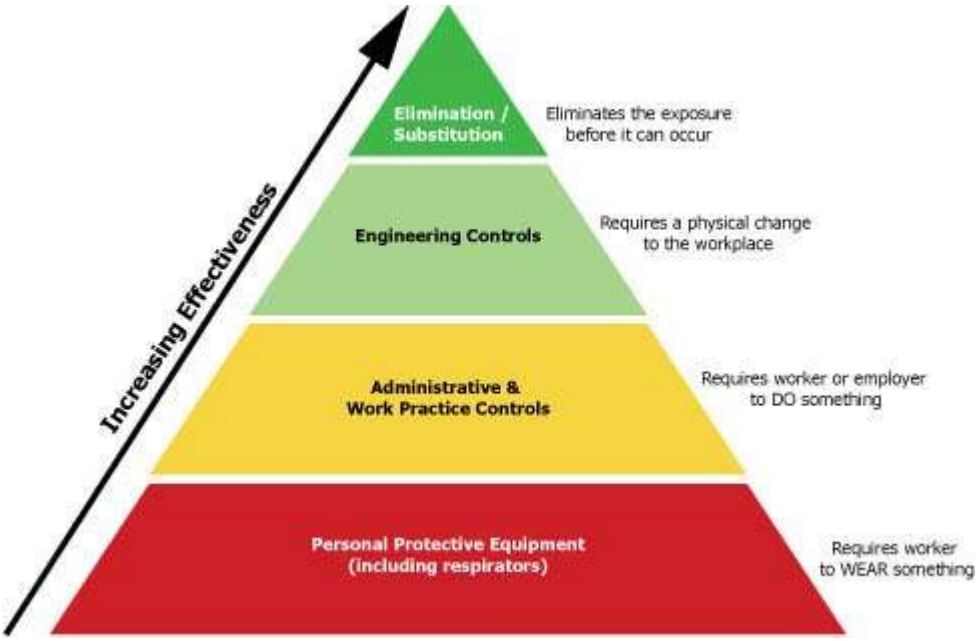


Figure 1: Hazard Mitigation Effectiveness Pyramid

1.5.5 Engineering Controls, Work Practices, and PPE for Substances Regulated in Subparts G and Subpart Z

Engineering controls and work practices will be instituted to reduce and maintain employee exposure at or below the PELs for substances regulated by 29 CFR Part 1910.

Engineering controls that may be feasible include the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices may include removing non-essential employees from potential exposure during opening of drums, wetting down dusty operations, and positioning employees upwind of potential hazards.

If engineering controls and work practices are not feasible, or not required, a reasonable combination of engineering controls, work practices, and PPE will be used to reduce and maintain at or below the PELs or dose limits for substances regulated by 29 CFR Part 1910, Subpart Z.

GEI will not implement a schedule of employee rotation as a means of compliance with PELs or dose limits except when there is no other feasible way of complying with the airborne or dermal dose limits for ionizing radiation.

The provisions of 29 CFR, subpart G, will be followed.

1.5.6 Engineering Controls, Work Practices, and Personal Protective Equipment for Substances Not Regulated in Subparts G and Subparts Z

An appropriate combination of engineering controls, work practices, and PPE will be used to reduce and maintain employee exposure to or below published exposure levels for hazardous substances and health hazards not regulated by 29 CFR Part 1910, Subparts G and Subparts Z. GEI will use published literature and Safety Data Sheets (SDS) as a guide in making the determination of what level of protection is appropriate for hazardous substances and health hazards for which there is no permissible exposure limit or published exposure limit.

1.5.7 Decontamination Procedures

Decontamination procedures will be developed, communicated to employees, and implemented before employees or equipment enter areas on site where potential for exposure to hazardous substances exists. Procedures will be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.

GEI employees leaving a contaminated area will be properly decontaminated; contaminated clothing and equipment leaving a contaminated area will be properly disposed of or decontaminated.

Decontamination procedures will be monitored by the site safety officer (SSO) to determine their effectiveness. When such procedures are found to be ineffective, the site safety officer will contact the Corporate Health and Safety Officer and appropriate steps will be taken to correct deficiencies.

Location
Decontamination will be performed in areas that will minimize the exposure to employees, equipment, and the environment.

Equipment and Solvents
Equipment and solvents used for decontamination will be decontaminated or disposed of properly.

Personal Protective Clothing and Equipment
Protective clothing and equipment will be decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain their effectiveness.

Employees whose clothing comes in contact with hazardous substances will immediately remove that clothing and follow the directions on packaging or SDS sheet for how to properly clean the exposed area. The clothing will be disposed of or decontaminated before it is removed from the work zone.

Commercial Laundries or Cleaning Establishments
Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment will be informed of the potentially harmful effects of exposures to hazardous substances.

Showers and Changing Rooms
Where the decontamination procedure indicates a need for regular showers and change rooms outside of a contaminated area, these will be provided and meet the requirements of 29 CFR 1910.141 (Sanitation). If temperature conditions prevent the effective use of water, then other effective means for cleansing will be provided and used.

1.6 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health and Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.7 Limitations

None

1.8 References

OSHA 1910.120 Hazardous Waste Operations and Emergency Response
OSHA 1910 Subpart G Occupational Health and Environment Control
OSHA 1910 Subpart Z Toxic and Hazardous Substances
OSHA 1910.141 General Environmental Controls – Sanitation
http://www.business.govt.nz/worksafe/information-guidance/legal-framework/hsno-act-1996/defining-hazardous-substances/ (Viewed 7/8/2016)
https://www.osha.gov/SLTC/hazardoustoxicsubstances/ (Viewed 7/8/2016)
https://www.osha.gov/SLTC/hazardoustoxicsubstances/control.html (Viewed 7/11/2016)

1.9 Attachments

None

1.10 Contact

Health&SafetyTeam@geiconsultants.com

1.11 Review History

- July 2016
- May 2014
- November 2013
- August 2011 known as Hazard Identification and Management
- February 2011 known as HS-008 Contaminant Properties

STANDARD OPERATING PROCEDURES

SOP No. HS-010 Inclement Weather

1.1 Objective

This Standard Operating Procedure (SOP) is intended for use by employees engaged in work with the potential to be affected by inclement weather. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for working in inclement weather and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.2 General

Employees should be aware of local weather conditions and monitor advisories issued by the National Weather Service and other local reporting services. Depending on location and season, storms are capable of producing heavy rain, floods, extreme temperatures, high wind conditions, lighting, tornados, and/or snowfall.

1.2.1 Heavy Rain

If working or driving in a rain storm, use extreme caution. When driving, turn your low beam lights on when the rainfall becomes heavy. Employees should be aware of the following:

- Heavy rain decreases visibility, especially when driving.
- Surfaces and tools become slippery.
- If you are working in the rain and your clothes become wet there is a risk of hypothermia when exposed to winds, even in warm temperatures.
- If the storms are going to produce thunder and/or lightning, leave the work area immediately and move to a safe area.
- Use your best judgment to determine if the rainfall becomes too heavy to continue working safely.

1.2.2 Lightning

Lightning can strike as far as 10 miles from the area where it is raining. That's approximately the distance you can hear thunder. **If you can hear thunder, you are within striking distance. Seek safe shelter immediately.** This can be within a building or vehicle. Wait 30 minutes after the last clap of thunder or flash of lightning before going outside again.

1.2.3 Flooding

Flooding may occur as a result of heavy rain in a short period of time. Flooding can be particularly acute in canyon areas where dry creek beds can turn into raging rivers from rainfall in distant or higher elevation areas. Be aware of this and your surroundings and move to a safe place if you begin to see signs that flooding may occur. Signs of potential flooding include sudden appearance of water in dry creek beds, increased water flow in rivers or streams, or quick rise in water levels.

Do not attempt to drive through areas or streets that are flooded. Seek alternate routes. Be particularly cautious at night when flooded areas are difficult to see. Urban flooding can stop traffic; increase the potential for traffic accidents; and can trap people in vehicles.

1.2.4 Extreme Temperatures

Work activities may take place in extreme heat or cold. Be prepared if these conditions are anticipated. Have the appropriate personal protective equipment (PPE) available; exercise proper fluid intake; and take breaks to prevent heat and cold stress. For more information about these conditions see the heat stress and cold stress programs found in GEI's Health and Safety Program.

1.2.5 High Winds, Tropical Storms, and Tornados

High Winds can be extremely dangerous. Appropriate measures will be taken to secure equipment and loose items when working in windy conditions. The project manager should be contacted about the weather conditions and, if necessary, work should be postponed.

Tropical storms are described as storms with sustained winds ranging from 39 to 73 miles per hour (mph) and hurricanes produce sustained winds that exceed 74 mph. When winds approach 40 mph (gale force winds) twigs begin to break off of trees and vehicles will veer off of the road. When winds approach 40 mph or the GEI employee feels unsafe based on the activities being performed, stop work and seek shelter as soon as possible. Blowing or falling debris and overhanging limbs/signs can be a significant hazard. If possible, avoid driving in these conditions; 70 percent of injuries during hurricanes are a result of vehicle accidents. Note that tall or elevated equipment will have manufacturer's safe operating wind speeds defined that could be less than 40 mph. The operator's manual should be consulted prior to operation of the equipment.

A tornado is a violent, dangerous, rotating column of air that is in contact with both the surface of the earth and a cumulonimbus cloud or, in rare cases, the base of a cumulus cloud. The Fujita Scale is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure. Based on the Fujita Scale, or F-Scale, numbers begin at F0: 40-72 mph and go to F6: 319-379 mph (F6 is

generally theoretical). Nearly three-fourths of tornados are on the weak F0-F1 scale with just over two-thirds of deaths resulting from the violent F4-F5 tornados.

If a tornado is seen, stop work and seek shelter immediately. If a tornado siren is sounded move immediately to safety indoors and then move to a windowless interior space, basement, stairwell, or designated fall-out shelter. Windows should not be opened before an oncoming tornado. If there is no shelter available, seat belt yourself into your stationary vehicle or seek a depression or low spot on the land surface.

1.2.6 Snowfall and Ice Conditions

Working in the winter months may result in activities taking place during periods of snowfall or icy conditions. If you are working during or after snow has fallen, dress appropriately for the conditions. Snow and ice can cause working surfaces to become slippery. Clear snow and ice from work areas to prevent slip hazards. Use caution when performing snow or ice removal activities to prevent injuries. Driving in snowy and icy conditions is also hazardous. Reduce speed and use caution if you must drive in these conditions.

If the weather conditions deteriorate and you do not feel safe working in these conditions, stop work, move to a safe indoor location, and contact your project manager to let them know the weather, work conditions, and your location.

1.3 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.4 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection. Protection in extreme weather conditions can best be accomplished if the conditions are anticipated and actions are taken. Monitor local weather conditions prior to starting work.

1.5 References

Center for Disease Control and Prevention – Natural Disasters and Severe Weather
http://www.bt.cdc.gov/disasters/

National Lightning Safety Institute

NOAA, National Weather Service

Office of Climate, Water, and Weather Services

1.6 Attachment

None

1.7 Contact

Safety Team
Health&SafetyTeam@geiconsultants.com

1.8 Review History

- Previous revision dates were not documented
- May 2014
- July 2016

STANDARD OPERATING PROCEDURES

SOP No. HS-012 Noise Exposures

1.1 Objective

This Standard Operating Procedure (SOP) is intended for use by employees engaged in work with elevation noise levels. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for work in loud environments and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.2 General

Working in loud environments can cause hearing damage and loss if the proper protection is not in place. The following procedures describe methods to mitigate unhealthy noise levels and protect hearing.

1.3 Hazard Identification

If projects involve noise levels above OSHA regulations, employees should take steps to remove the noise exposure. Common sources of elevated noise levels are heavy equipment, power tools, pumps, and generators. GEI has an established Hearing Conservation Program located in the GEI Health and Safety Program.

1.4 Risk Identification

Hearing protection is required if noise levels in a work area are known to be above 85 decibels (dB), which can be measured with a noise meter. When decibel levels are not known, hearing protection is required if you need to raise your voice to talk to someone standing within a normal speaking distance from you.

1.5 Mitigation

There are three options that can be used to help mitigate a noise hazard:

1.) Remove the hazard by taking away the source of the noise.

2.) Remove the employee from the source of the noise.

3.) Provide the employee with appropriate personal protective equipment (PPE).

The first option for employee protection is to remove the hazard by taking away the source of the noise or using engineering controls to reduce the level.

If this cannot be accomplished, the next control measure is to remove the employee from the source. This can be done by moving the work area to a quieter location or distancing the employee from the noise source. For example, GEI employees do not need to be standing next to an operating drill rig or other heavy equipment. By distancing themselves from heavy equipment or other noise sources the need for hearing protection can be eliminated/reduced.

The final option, if the above two options aren't feasible, disposable ear plugs that are made available to GEI employees are to be used. Additional means of hearing protection will be provided, such as ear muffs, if the disposable ear plugs are not adequate.

When using hearing protection, employees will need to make a greater effort to be aware of the surroundings which may include moving equipment, traffic, and other site hazards.

1.6 Proper Use of Hearing Protection

DISPOSABLE EAR PLUG FITTING INSTRUCTIONS

Before fitting any ear plugs, make sure your hands are clean.
Foam ear plugs are disposable and not intended for reuse.

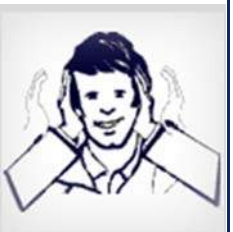
Hold the ear plug between your thumb and forefinger. Roll and compress the entire ear plug to a small, crease-free cylinder. While still rolling, use your other hand to reach over your head and pull up and back on your outer ear. This straightens the ear canal, making way for a snug fit.



Insert the ear plug and hold for 20 to 30 seconds. This allows the ear plug to expand and fill your ear canal.



Test the fit. In a noisy environment, and with earplugs inserted, cup both hands over your ears and release. You should not notice a significant difference in the noise level. If the noise seems to lessen when your hands are cupped over your ears, your ear plugs are not fitted properly. Carefully remove the earplugs (see instructions below) and refit following instructions, above.



Always remove ear plugs slowly, twisting them to break the seal. If you remove them too quickly, you could damage your ear drum.	

REUSABLE EAR PLUG FITTING INSTRUCTIONS

Before fitting any ear plugs, make sure your hands are clean.

Reusable ear plugs should be inspected and cleaned often in soapy water. If they become hard, torn, or deformed they should be discarded and replaced.

Reach around your head and pull up and back on your outer ear. This straightens out the ear canal, making way for a snug fit. Hold the stem end of the ear plug and insert it well inside your ear canal until you feel it sealing and the fit is comfortable.	
Test the fit. In a noisy environment, and with ear plugs inserted, cup both hands over your ears and release. You should not notice a significant difference in the noise level. If the noise seems to lessen when your hands are cupped over your ears, your ear plugs are not fitted properly. Carefully remove the ear plugs (see instructions below) and refit following instructions, above.	
Always remove ear plugs slowly, twisting them to break the seal. If you remove them too quickly, you could damage your ear drum.	

1.7 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety

Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, People Team, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.8 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.9 References

OHSA 29 CFR 1910.95 – Occupational Noise Exposure

OHSA 29 CFR 1926.101 – Hearing Protection

Texas American Safety Company (TASCO)

1.10 Attachments

None

1.11 Contact

Health&SafetyTeam@geiconsultants.com

1.12 Review History

- June 2016
- May 2014
- November 2013
- February 2011
- November 2010

STANDARD OPERATING PROCEDURE

SOP HS-014 Utility Mark-out

1.1 Objective

This Standard Operating Procedure (SOP) provides guidance for utility mark-out procedures related to drilling, excavation, or other sub-surface or intrusive activities to avoid injury to GEI employees or property damage. This SOP is applicable when GEI is responsible for its operation or our subcontractor's operation for utility mark-out. A utility mark out is when paint, flags or other markers are put in place to identify the location of an underground utility.

Clients or local agencies may have additional requirements or procedures to mark out of utilities. If local utility mark-out procedures differ from those described within this SOP, applicable state or municipal regulations should be followed.

1.2 General

This SOP is intended for use by employees engaged in work with sub-surface or intrusive activities. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for subsurface hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.2.1 Contractor/GEI Responsibilities

- The contractor or GEI employee will pinpoint each exploration area with white paint, flags, or stakes. personal protection equipment (PPE), including eye protection when using spray paint will be worn.
- Exploration locations should be marked-out with sample identification number(s) and type of sample (e.g., boring, test-pit, or monitoring well).
- The contractor compiles information about the work areas on a request form specified by the state utility mark-out program and submits it. Work area location maps can be sent to the utility mark-out program to clarify locations.
- The mark-out program customer service representative will provide a mark-out ticket number and a list of utilities notified upon receipt of the request information. This information will be recorded on the GEI documentation form in Appendix B and/or in other project documents.
- If known, the contractor or GEI employee will also notify non-member utility operators (e.g., apartment complexes, commercial complexes, railroads with communication cables, etc.).

1.2.2 Utility Mark Outs

- Utility companies or their sub-contractors will only mark-out, or clear, utilities under their responsibility. Generally, this means that they will only mark-out utilities within the public right-of-way up to private property boundaries. Information needed to determine the location of utilities on private properties will be requested from the property owner. This may include available property drawings or as-built figures. If this information is not available, additional non-intrusive surveys of the property may be required by a private utility locator to find underground utilities by using techniques such as ground penetrating radar (GPR).
- American Public Works Association (APWA) Uniform Color Code For Marking Underground Utility Lines are:
    1. **White** – Proposed Excavation
    2. **Pink** – Temporary Survey Markings
    3. **Red** – Electric Power Lines, Cables, Conduit and Lighting Cables
    4. **Yellow** – Gas, Oil, Steam, Petroleum, and Gaseous Material
    5. **Orange** – Communications, Alarm, Signal Lines, Cables or Conduit
    6. **Blue** – Water
    7. **Purple** – Radioactive Materials
    8. **Green** – Sanitary and Storm Sewers and Drain Lines

1.2.3 Utility Mark Out Review

- Before the intrusive work activities begin, the contractor or GEI employee will verify that each utility company has completed a utility location for the work area or the location has been cleared by a private locator and record this on the mark-out request information sheet.
- A visual survey of the project area will be done prior to the start of intrusive activities. This visual inspection will be done to identify signs, manholes, utility boxes, or other evidence of an underground utility is present and has been considered.
- The contractor or GEI employee can begin work on the scheduled work date and time if the utility operators have responded, taking care to find and preserve markings that have been made.
- Completed clearance documentation will be located on the excavation site during excavation activities and kept in project files.

1.2.4 Excavations

- When excavating near a buried utility, observe the approximate location around that utility.
- If exposing a utility, proper support and protection must be provided so that the utility will not be damaged.
- If the excavation work requires significant spans of the utility to be exposed, it is the contractor's responsibility to support the infrastructure (to prevent sagging or collapse) as needed. Contact the utility operator for support, guidance, or assistance.
- When the excavation is complete, provide proper backfill for utilities that have been exposed.
- Take care not to damage the conduit or protective coating of a utility. If the damage occurs, leave the damaged utility exposed and immediately call the utility owner.
- If a gas line is encountered, everyone will be evacuated according to the site evacuation procedures and the contractor must notify police, fire, and emergency personnel. No attempt should be made to tamper with or correct the damaged utility. All site personnel are to evacuate to the site's predetermined meeting point or a location a minimum of 300 feet away from the incident location.
- If the contractor needs to dig within the approximate location of a combustible, hazardous fluid, or gas line (natural gas, propane or gasoline), soft digging is required (hand digging, vacuum extraction) to a maximum depth of 5 feet. The approximate location is defined as 24 inches on either side of the designated center line of the utility if the diameter is not provided or 24 inches from each outside edge if the diameter is provided.

1.3 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification and/or the receipt of the Incident Report Form, RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.4 Limitations

- Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.
- Mark-out notification time usually does not include holidays. Make sure holidays are considered and mark-out time is scheduled accordingly. Under no circumstances are intrusive activities allowed to be performed prior to the required mark-out.
- Do not use white paint if precipitation is eminent. Consider using stakes if snow is predicted.

1.5 References

Reference the website for the "Call Before You Dig – 811" for the utility mark-out agency for the state you working in prior to site work. If you have issues locating the appropriate agency, contact the Safety Team for assistance.

1.6 Attachments

Attachment A – Standard Utility Color Codes

Attachment B – GEI Utility Clearance Documentation Form

1.7 Contact

Health&SafetyTeam@geiconsultants.com

1.8 Review History

- June 2016
- May 2014
- November 2013
- February 2011
- November 2010

ATTACHMENT A

COLOR CODE FOR UTILITY MARKING

(BASED ON 'THE AMERICAN PUBLIC WORKS ASSOCIATION' RECOMMENDATIONS AND THE ANSI STANDARD Z-53.1 FOR SAFETY COLORS)

UTILITY	COLOR
PROPOSED EXCAVATION	WHITE
ELECTRIC POWER LINES, CABLES, CONDUIT AND LIGHTING CABLES	RED
POTABLE WATER	BLUE
STEAM, CONDENSATE, GAS OR OIL COMPRESSED AIR	YELLOW
TELECOMMUNICATIONS, ALARM OR SIGNAL LINES, CABLES OR CONDUIT	ORANGE
TEMPORARY SURVEY MARKINGS	PINK
SEWER AND STORM DRAINS	GREEN
CHILLED WATER, RECLAIMED WATER, IRRIGATION AND SLURRY LINES	PURPLE
OTHER	LIGHT BLUE

ATTACHMENT B

Utility Clearance Documentation

Please print clearly. *For more room, use back of page.*

Client: _____

GEI Project Name & Number: _____

Site: _____

Excavation/Drilling Location ID: _____

Excavator/Driller: _____

GEI PM: _____ GEI Field Team Leader: _____

Utility Drawings Reviewed: _____

Provided By: _____ Reviewed By: _____

Utility Clearance Call Date: _____ Name of Utility: _____

Utility Clearance Call Date: _____ Name of Utility: _____

Utility Clearance Received from (utility & rep name): _____ Date: _____

Utility Clearance Received from (utility & rep name): _____ Date: _____

Company that completed clearance: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Metal Detector Survey (yes/no): _____ Drilling Location Cleared by: _____

Contractor Name: _____ Company Name: _____

Contractor Signature: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Private Location Clearance Required (yes/no): _____ Date: _____

Contractor Name: _____ Company Name: _____

Contractor Signature: _____ Date: _____

Methods used for utility location (i.e. GPR, electronic pipe location) _____

GEI Staff Responsible for Oversight: _____

Hand clearing Performed (yes/no): _____ Methods: _____ Date: _____

Contractor Name: _____ Company Name: _____

Contractor Signature: _____ Date: _____

GEI Staff Responsible for Oversight: _____

GEI Consultants, Inc. Representative (name & title): _____

GEI Consultants, Inc. Representative Signature: _____ Date: _____

Based upon the best available information, appropriate utility clearance procedures were performed for the invasive work specified. If client ordered site specific deviations from existing GEI utility clearance procedures, they are approved by the client signature below:

Client Representative (name & title): _____

Client Representative Signature: _____ Date: _____

Notes:

STANDARD OPERATING PROCEDURES

SOP No. HS-016 Traffic Hazard Management

1.1 Objective

The objective of this Standard Operating Procedure (SOP) is to prevent or limit the potential for GEI personnel to encounter traffic hazards during field activities.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for traffic hazards. The site-specific health and safety plan (HASP) will include a hazard assessment for the project that identifies the potential for exposure to traffic hazards and the control methods to be implemented by GEI employees, including review or attainment of necessary permits, traffic control plans, and flagger/police detail requirements for the local jurisdiction. Routine checks of the work zone will be made to ensure there are adequate levels of protection. These hazards will be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Traffic Hazard Management

Traffic Hazard Management is the process of identifying and managing the potential risks associated with the movement of traffic through, around, or past a work area. This Traffic Hazard Management SOP is designed to assist employees in identifying and managing these hazards. Work areas should be as safe as possible. It is the responsibility of GEI employees to follow the Traffic Hazard Management SOP and adhere to these safety standards. Safety is not negotiable.

Under no circumstances are GEI employees permitted to commence work in a situation that the employee believes or knows their health and safety, or the health and safety of others, is at risk.

Major risk factors for work site Traffic Hazard Management include:

- The speed of traffic moving through a work site.
- The distance and clearance between moving traffic, workers, vehicles and equipment, and over-head power lines.
- Traffic volume and vehicle composition.
- Nature and conditions at the work site and approaches to the work site.

- Other factors such as the time of day, sight distance, weather, presence of pedestrians, or cyclists, and the type of work being carried out.
- Other hazards in proximity to the work site (e.g., power lines, open excavations) that may have conflicting safety management measures that need to be considered when developing the HASP.

1.4 Site Preparation

The following management measures will be considered whenever working in traffic areas. In addition, remain aware of the amount of traffic around the working area. The work space should be large enough for the job to be completed safely. Check permit, traffic control plans, and flagger/police detail requirements for the local jurisdiction. Perform routine checks of the work zone to make sure there are adequate levels of protection.

1.4.1 Traffic Barriers and Warning Signs

GEI employees will comply with the U.S. Department of Transportation's (DOT) Manual on Uniformed Traffic Control Devices (MUTCD) and/or state regulations for temporary traffic barriers (cones, barriers) and sign placement when required for working in traffic areas. Clearly define the work site by placing traffic barriers around the work space to indicate the space that is needed to safely perform the work. The traffic barrier will help make the work site more visible to other workers, pedestrians, cyclists, and moving vehicles. Place traffic barriers in such a way as to give yourself and equipment adequate space to work within the barriers. OSHA suggests placing the first warning sign at a distance calculated to be 4 to 8 times (in feet) the speed limit (in MPH).

1.4.2 Adequate Light

Requirements for night conditions and work areas with poor visibility are similar to day requirements. However there are a number of additional things to consider, such as visibility of the work site to advancing traffic and sufficient lighting. OSHA requires lighting for workers on foot and equipment operators to be at least 5-foot-candles or greater.

Visibility of the work area can be increased by employing the following measures:

- Using parked vehicles hazard and flashing lights.
- Wearing reflective personal protective equipment (PPE), such as a safety vest, in good condition.
- Providing adequate lighting to illuminate the work area with lights positioned so that there is no glare to approaching drivers.
- Placing reflective advance warning signs and traffic barriers so that they are visible to road users.

1.4.3 Distance from the Nearest Traffic Lane

Work areas located along roadsides will have a minimum clearance as defined by DOT's MUTCD and/or state or local DOT regulations for traffic barrier and sign placement.

1.4.4 PPE

The proper PPE, as outlined in the project HASP, will be worn when appropriate. The color/type of safety vest will comply with site regulations.

1.5 Equipment Operation

Vehicles and heavy equipment operators should use a spotter when possible if it is necessary to drive in reverse to reduce risk of collision with oncoming traffic. If it is necessary to drive against the flow of traffic make sure this area is within the work zone and properly blocked off from oncoming traffic.

1.6 Pedestrian Safety

When working near pedestrian traffic, a safe alternate pedestrian route will be established. Refer to local regulations when establishing pedestrian walkways.

1.7 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.8 Limitations

Follow safety procedures as defined in the site-specific HASP, federal DOT, and local jurisdictions. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.9 References

DOT's Manual on Uniformed Traffic Control Devices (2009 Edition)

Hazard Exposure and Risk Assessment Matrix for Hurricane Response and Recovery Work: https://www.osha.gov/SLTC/etools/hurricane/work-zone.html

1.10 Attachments

None

1.11 Contact

Health&SafetyTeam@geiconsultants.com

1.12 Review History

- November 2016
- May 2014
- November 2013
- August 2011
- October 2010 Initially HS-027 Traffic Hazards

STANDARD OPERATING PROCEDURES

SOP No. HS-018 Working Around Heavy Equipment

1.1 Objective

The objective of this Standard Operating Procedure (SOP) is to prevent or limit the physical hazards when working around heavy equipment.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for working near heavy equipment. The project site-specific health and safety plan (HASP) should include a hazard assessment for working near heavy equipment to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Heavy Equipment Precautions

Heavy equipment (e.g., excavators, backhoes, drill rigs, etc.), can present many physical hazards that can result in serious injury or death if the proper safety precautions are not followed. The following is a list of precautions to be aware of when working around heavy equipment:

- Wear appropriate personal protective equipment (PPE), including at a minimum reflective, high-visibility safety vest, hard hat, safety glasses, and steel/composite toe boots.
- Always keep your distance from moving equipment.
- Do not assume the operator knows where you are or where you are going.
- Make sure to make eye contact and receive acknowledgement of your presence with the operator.
- Avoid working near heavy equipment, but if unavoidable, communicate your location with the operators. If using hand signals, discuss the signals with the equipment operator prior to starting work.
- Watch for moving equipment. Construction sites can have a lot of activity and equipment may be moving in an unpredictable manner.
- Do not rely on back-up or other alarms. They may not be working or you may not hear them with the noise of other activities taking place in the area.
- Stay out of the swing radius of cranes, excavators, or other equipment that swings or rotates.
- Do not walk beside a moving vehicle, the vehicle may turn, slip, or the load may shift causing the vehicle to go off course.
- Do not ride on the outside of a moving equipment.

- Never walk under or stand too close to a load suspended by cranes or hoists.
- Do not walk behind a piece of equipment that is backing up without acknowledgment from the operator it is safe to proceed. If working next to heavy equipment is unavoidable, be aware of the hazards including pinch points and moving parts. Use a spotter to watch the work area for moving equipment.
- If necessary, ask the operator to stop equipment operation to perform your work tasks.
- Verify the location and operation of emergency shut-off devices on the equipment.
- Be aware of the fuels and chemicals associated with the equipment. Have a spill prevention and response plan in place that includes the appropriate containment materials (i.e., spill kit).
- Do not wear loose fitting clothing when working around moving equipment (i.e., drill rig augers).
- Do not operate heavy equipment.
- Do not use cellular telephones near operating equipment.

1.4 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.5 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.6 References

OSHA 29 CFR 1926.600 – Subpart O; Motor Vehicles, Mechanized Equipment, and Marine Operations.

www.toolboxtopics.com/Construction/ (Viewed 10/16)

Caterpillar Safety – http://safety.cat.com/ (Viewed 10/16)

1.7 Attachments

None

1.8 Contact

Health&SafetyTeam@geiconsultants.com

1.9 Review History

- October 2016
- May 2014
- November 2013
- August 2011
- October 2010

STANDARD OPERATING PROCEDURES
SOP No. HS-024 Wilderness Safety

1.1 Objective

Employees may be involved with projects that requires performing tasks that include traversing through wilderness areas. The following guidelines, along with the site-specific health and safety plan (HASP) and standard operating procedures (SOPs) will be followed when employees perform work in wilderness areas.

1.2 General

The purpose of this standard operating procedure (SOP) is to assure the safe deployment and return of personnel during field activities involving traversing through wilderness areas. The HASP will include a hazard assessment for the project that identifies the potential for encounters with wilderness hazards and the control methods to be implemented by GEI employees. These hazards will be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Trip Planning

1. **Always communicate your itinerary** with other employees to include routes to be used, and estimated travel/return times. Create a Trip Plan and leave it with a reliable person who will be expecting your return.

2. **Set a deadline** for when sending out assistance should be considered if you are overdue or haven't been in communication with anyone.

3. **Before your trip**, learn about the hazards you may encounter and take adequate precautions. Select appropriate clothing and pack first aid kits, and safety equipment in a backpack. Essentials include, but are not limited to: plenty of water, and high energy food, signal mirror, matches, emergency thermal foil blanket, whistle, bear spray (worn in a quickly accessible locations such as a hip or chest holster) (MFWP, 2017) , etc. Make sure cell phones are fully charged. If cell phone coverage is not expected take alternate forms of communications such as a SPOT GPS device, contact the Regional Health and Safety Officer (RHSO) or Corporate Health and Safety Officer (CHSO) for additional information. Check weather reports and reschedule trip if needed.

4. **Know your own limitations**. Do not attempt to traverse areas that you or your coworkers are not physically capable of handling. You are responsible for your safety; be alert and stay alive.

5. **Track your location** using map and/or compass. If you don't have this knowledge, let your project manager and the safety team know so that arrangements can be made for proper training. If you encounter trouble, do not hesitate to turn back. SPOT GPS devices are also available for employee use.

6. **During bad weather** like rain, snow, and fog, you may be safer if you stay put rather than attempt to travel.

Source: National Park Service (NPS, 2017a).

1.4 Stream Crossings

Most major stream crossings are bridged, but not all. High water or bridge damage can also mean encountering unexpected or difficult stream crossings. In addition, water releases from dams upstream may impact stream flow rates and water levels. Check with Dam Operators to determine if releases are in progress or scheduled.

Time your crossing accordingly. Find the best crossing area by looking for wider, shallower areas with safe downstream conditions. Cross in the morning before snowmelt swells the water level, if applicable. Unbuckle your pack straps, wear secure footwear, and angle your travel across the current. Don't tie yourself to another person or object while you cross. *Do not attempt an unsafe crossing*—if in doubt, turn back or wait for help.

1.5 Trail Conditions

With a few exceptions, most trails typically follow valley bottoms to high passes, as the terrain is usually too steep to follow high ridges. This may also be true around lakes, reservoirs and wetland areas. Trails are often not marked or easily identified, or may be covered with deep snow. Contact the Ranger Station prior to departure to verify trail conditions.

1.6 Snow Travel

Travel over steep snow requires the proper equipment and clothing which may include sturdy waterproof insulated boots, an ice axe, heavy duty rope, cold weather clothing, and gloves. Slip, trips, and falls are of primary concern on snow covered trails, more so on ground sloping towards water such as streams, lakes, and reservoirs. A hazard assessment for these conditions, and their controls, will be included in the HASP.

1.7 Hypothermia

Hypothermia is "a medical emergency that occurs when your body loses heat faster than it can produce heat, causing a dangerously low body temperature." (Mayo Clinic, 2017) Hypothermia can occur quickly or more slowly from long exposure to cold, rain and wind. It is possible to get hypothermia in temperatures as high as 50 degrees Fahrenheit.

Early signs of the condition are hard to detect, so when it is wet and cold, watch for these symptoms in your party: poor judgment, lethargy, shivering, and clumsiness. Prevent hypothermia by wearing wool or synthetic layers (NOT cotton), stocking cap, and rain gear.

Avoid exposure to the wind, especially when wet or sweaty. Wear adequate rain gear and wool or polypropylene clothing layers, not cotton. Nearly half of body heat is lost through the head, so always wear a stocking cap when weather dictates. Eat high-energy foods. Treatment of hypothermia can be complex, but the key is to prevent further heat loss, and to re-warm and re-hydrate the victim.

1.8 Heat Illness

Heat exhaustion can be brought on by warm weather, exertion, and dehydration. Symptoms are hot, red, moist skin and fatigue, frequently accompanied by a headache. When the weather is warm, take frequent short breaks in the shade, and drink plenty of water. If your urine is dark yellow, you need to drink more water. Failure to observe and treat the signs of heat exhaustion can lead to heat stroke, an extremely serious condition.

1.9 Emergencies

It is important to track your location using map and/or compass. If you encounter trouble, do not be hesitate to turn back. SPOT GPS devices are also available for employee use. If you become injured, provide whatever treatment you can. Do not leave an injured person alone. Use either your cell phone or the SPOT technology to contact emergency services for help.

If cellular service is available, call 911 and provide the following information:

- Nature of the emergency: date and time it occurred, details of incident and injuries.
- Your name and cell phone number.
- Injured person's condition: airway, breathing and circulation—normal or on the extreme? Has first aid been given? Is CPR in progress?
- Location: the closest known location, or approximate distance or walking time from a known location. Mark it on your topo map as best you can.
- Resources: number of people (adult/juvenile) and equipment left at the scene.
- Injured person's information: name, address, phone, age, weight, who to notify.
- Color of injured party's belongings: tent, pack, clothing.

If you become lost, stay calm and think through the situation. Use your cell phone or SPOT GPS Device, if possible. Refer to your position on the topo map. If you are truly lost, stay where you are—you will be found sooner. Stay warm and dry. If you are tempted to follow a river or creek, remember that these are often the most dangerous routes. Create a signal visible from the air. Lay out brightly-colored clothing in a forest clearing. Use a signal mirror. If possible, build a shelter to reduce exposure to the elements and place a bright color item outside.

1.10 Cell Phones

Because cell phone coverage may be patchy in wilderness areas, have a SPOT GPS Device on-hand. If there is no SPOT GPS Device and cell phone coverage is lacking or intermittent, there may be a chance to reach a cell signal by climbing to a ridge top. If it's not safe to climb to the ridge top, do not attempt it. From the backcountry, report emergencies by calling 911 or pushing the appropriate button on your SPOT GPS Device. Once connected to an emergency operator, state who you are, your specific location, and the other information outlined under Section 1.9, above. Knowledge of one's location is vital to the success of any rescue, therefore **it is important to track your location** using map and/or compass. Also, provide your cell phone number so you can be called back; don't move if they are planning to return a call. Sometimes just a foot or two makes a difference in getting a call through to a cell phone in the wilderness.

1.11 Cougars and Bears

As you walk in the wilderness, keep an eye out for wildlife tracks. If you notice cougar tracks, "(four toes, and usually no claw prints since their claws are retractable) and droppings, and scan trees for fresh claw marks. If you see something that signals that a cougar might be in the area, consider making a returning the way you've come from before you encounter one face-to-face." (The Clymb, 2017)

If you are in known cougar or bear territory, it's a good idea to be noisy to avoid startling a cougar or a bear. Talk among your group, carry a bell, and get extra loud when the wind is blowing strong or around loud water. (The Clymb, 2017)

1.11.1 Cougars

Seldom seen, cougars (also called mountain lion, puma, panther, or catamount) are large animals, often over 100 pounds, with long rope-like tails. They are usually reddish-tan to gray-brown, with black markings on the face and tail tip. Report all cougar sightings to a ranger. The cougar is a potentially dangerous animal, although attacks on humans are rare.



Cougar.
Photo source: Wikipedia.

Keep bear spray in a readily-accessible location (hip or chest holster) at all times; it may help to deter an attacking lion. (MFWP, 2017)
See subsection "Bear Spray and Cougars" below.

If you see a cougar:

- Ready your can of bear spray (with the safety removed).
- Pick up small children immediately so they won't panic, flee, or make rapid movements.
- Do not approach, especially one that is near a recent prey-kill or has kittens.
- Stop. Stay calm and do not turn your back. Do not run.
- Face the animal, stand upright, talk calmly and firmly to the cougar and give it a way to escape if you can.
- Do all you can to appear larger, for example, open your jacket and slowly raise and wave your arms.
- If the cougar becomes more aggressive, become more aggressive toward it; convince the animal that you are not prey, but a danger to it. Be prepared to use your bear spray in case the cougar approaches too closely.
- Fight back if attacked.

Bear Spray and Cougars. In 2001, A Montana Fish Wildlife and Parks (MFWP, 2017) mountain lion biologist and field technicians used bear spray to successfully thwart an attacking lion. Below are some guidelines that may help

> Bear spray goes out about 25 feet. If the user sprays a cloud 25 feet out and a lion is moving in from a greater distance, it could meet the cloud of active bear spray ingredients. However, mountain lions are less likely to charge so they may work their way around the initial orange cloud. Some experts

suggest that even the sound of the spray coming out of the can and the appearance of the orange cloud of capsaicin may be enough to deter a mountain lion that is simply curious or confused about whether what they see is prey.

Wildlife experts recommend a canister that contains six-seconds of spray. A burst of two to three seconds will create a cloud of orange. It may be necessary to spray a second burst if the animal retreats and returns, or if the first cloud disperses in the wind.

1.11.2 Bears

It's normal to be frightened when you encounter a bear. The reality is that most encounters with bears rarely lead to aggressive behavior and attacks are even rarer. Remember, most bears prefer to avoid contact with humans, and any bear you do see is probably just as frightened as you are. "Each bear and each experience is unique; there is no single strategy that will work in all situations and that guarantees safety. Most bear encounters end without injury. Following some basic guidelines may help to lessen the threat of danger. Your safety can depend on your ability to calm the bear." (NPS, 2017b)

Remain as composed as possible and follow these simple guidelines whenever you are in bear country. The best way to prevent an unpleasant bear encounter is to avoid them all together. Bears usually avoid people, and most people don't even know when they've come close to a bear.

To ensure a surprise or unpleasant encounter with a bear doesn't occur, avoid moving through bear habitat silently and alone. Travel in groups (the larger the better) and make lots of noise by talking or singing. Put distractive devices (e.g., smart phones, etc.) away and pay attention to your surroundings.

If You Meet a Bear

If you meet a bear on the trail, stop, remain calm, ready your bear spray (or other deterrent), and evaluate the situation. Identify yourself by speaking in a calm, appeasing tone. Stay together if you are in a group; you will appear larger and more intimidating. Remain still; stand your ground but slowly wave your arms. Make yourselves look as large as possible. Do not allow the bear to access your food. Do not drop your pack – you provide protection for your back.



American Black Bear.
Photo source: Wikipedia.

If the bear is stationary, **move away slowly and sideways**; this allows you to keep an eye on the bear and avoid tripping. Moving sideways is also non-threatening to bears. Do NOT run, but if the bear follows, stop and hold your ground. Bears can run as fast as a racehorse both uphill and down. Like dogs, they will chase fleeing animals. Do NOT climb a tree. Both grizzlies and black bears can climb trees. Leave the area or take a detour. If this is impossible, wait until the bear moves away. Always leave the bear an escape route. (Bear Smart, 2017; NPS, 2017b)

Bear Spray. Wear a can of bear spray in a hip or chest holster at all times. If a bear is near, keep a can of pepper spray ready (with the safety removed) in case the bear approaches too closely. Bear spray goes out about 25 feet.

Try to figure out whether the bear is a grizzly or a black bear. As you will see below, grizzly bears and black bears tend to behave differently in a given situation, so it helps to know which species you're dealing with. If possible, try to determine whether there are cubs present or whether the bear is defending an animal carcass or other food source. Females with cubs or bears defending food sources are more likely to act aggressively as they defend their cubs and/or food.

Back away slowly, preferably in the direction you came. Walk, don't run, and keep your eye on the bear so you can see how it will react. In most cases, the bear will flee.

Campsite

If you are in your campsite or other place bears shouldn't be, **and you are sure the bear is a black bear**, ensure the bear has a clear and safe escape route with no people or obstacles in its way. Stand tall and look it directly in the eye. Yell at the bear and firmly tell it to leave: "Get out of here, bear!" Keep a can of pepper spray ready (with the safety

removed) in case the bear approaches too closely. **Never try to "move" a grizzly bear!** (Bear Smart, 2017)

Dealing with a 'Defensive' Encounter

Sometimes a bear that feels threatened will 'act' aggressively to defend against a perceived threat. This is often the case with a mother bear with cubs, a bear defending a food source, or a surprise encounter. The closer you are to the bear when it becomes aware of you, the more likely it is to react defensively: it may pop its jaws or swat the ground with its front paw while blowing and snorting, and/or it may lunge or "bluff charge" toward you in an attempt to get you to leave.

In this situation, the bear doesn't want to fight any more that you do. It is simply trying to communicate that you are too close. Try to appear non-threatening by remaining still and calm. Ready your bear spray by removing the safety lock. Speak in an appeasing voice and back away, increasing your distance from the bear. Leave the area immediately.



Grizzly Bear. Photo source: Wikipedia.

ct almost always involve grizzly bears surprised at close range, on a carcass, or protecting young. The very few defensive attacks by black bears have been females protecting cubs (but these are very rare).

If you encounter a bear on a carcass, get as far away from the bear's cache as possible; leaving the area quickly and quietly preferably in the same direction you came in. If the bear is about to make contact, use your bear spray. Do not play dead and do not act aggressively. Get as far away from the food cache as possible. If you do not have your bear spray and the bear makes contact, fight back.

If a bear that is behaving defensively is intent on making contact, your first line of defense is always your bear spray. Point the nozzle just above the bear's head so that the spray falls into the bear's eyes, nose and throat. When it is 20 to 30 feet away, give it a long blast. That should be enough to discourage it and send it in the other direction. (Source: Bear Smart)

If the encounter was a surprise or it involves a grizzly bear with or without cubs, and *the bear makes physical contact*, fall to the ground and "play dead." Roll over onto your stomach and cover your neck and the back of your head with your hands. Keep your legs and elbows wide so the bear can't flip you over. When the attack stops, remain still and

wait for the bear to leave. Do NOT get up until you are absolutely certain the bear is no longer in the area – even if you have to wait 30 minutes or longer.

If an attack is prolonged or the bear starts eating you, it is no longer being defensive and it is time to fight back. Kick, punch or hit the bear with whatever weapon is available. Concentrate your attack on the face, eyes and nose. (Bear Smart, 2017)

1.11.3 Other Wildlife

During warm weather, black flies, deer flies, horse flies, spiders, and mosquitoes can be a nuisance. Wearing insect repellent, long sleeved shirts, and long pants may help. Yellow jackets are common in warm weather, and may nest in rotten logs or in the ground. Please *refer to* SOP, Biological Hazards (HS-001) for more information about insects and arachnids.

Deer are found nearly everywhere in the wilderness and show little fear of humans. Do not feed deer. They can be dangerous, striking out with their hooves or antlers. Feeding deer can also be harmful to their health. They crave the salt found in human urine, feces and food. An inadequately dug cathole latrine can be a deer's delight, so bury human waste properly (4-6 inches deep and 4-6 inches in diameter [SectionHiker, 2017]).

Nonnative mountain goats have become accustomed to human contact. Goats are also attracted to the salts in urine and sweat. To reduce their impacts on plants and soil, urinate on large rocks or areas free of vegetation, such as the trail tread. Store anything that smells of sweat, including clothes, boots and packs, inside your tent.

Mothers of some animals may become dangerous if you disturb their young. **Never get between a female bear and her cub.** Young animals, such as fawns, may be temporarily left by their mother. Do not be tempted to pick up these young animals, even if you think something is wrong with them. A lingering human scent can lead to abandonment.

1.12 Biological Hazards

Personnel may encounter potential biological hazards such as animals, insects, and plants when traversing through wilderness areas. The HASP will include a hazard assessment for encounters with biological hazards and control methods to be implemented by GEI employees. Specific information is available in SOP, Biological Hazards (HS-001).

1.13 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The CHSO will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.14 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE will be worn correctly to provide the intended level of protection.

1.15 References

GEI Consultants Inc. SOPs
HS-001 Biological Hazards
HS-010 Inclement Weather
HS-017 Water Safety

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The Clymb. “Avoid Cougar Attacks: 7 Things to Do If You Encounter a Big Cat”
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1.16 Attachments

None

1.17 Contact

Health&SafetyTeam@geiconsultants.com

1.18 Review History

- July 2016
- November 2015
- July 2014

STANDARD OPERATING PROCEDURES

SOP No. HS-025 Manual Lifting

1.1 Objective

The purpose of this Standard Operating Procedure (SOP) is to identify and reduce potential work-related musculoskeletal disorder (WMSD) hazards. The SOP is intended to comply with state regulations and safe work practices developed by the Occupational Safety and Health Administration (OSHA). Modifications to meet these requirements will be made to this program as changing laws or regulations dictate.

1.2 General

Lifting heavy items is one of the leading causes of injury in the workplace. Overexertion and cumulative trauma when lifting are significant factors for injuries. When employees use smart lifting practices and work in their “power zone”, they are less likely to suffer from back sprains, muscle pulls, wrist/elbow/spinal and other injuries caused by lifting heavy objects. Common things to consider prior to lifting an object are: weight of the object, awkward postures, high-frequency and long duration lifting, inadequate handholds, and physical/environmental factors.



Figure 1: Lifting Power Zone

1.3 Safe Lifting Guidelines

The following safe lifting guidelines will be followed by employees involved in manual lifting activities:

- Before manual lifting is performed, a hazard assessment must be completed. The assessment must consider size, bulk, and weight of the object(s), if mechanical lifting equipment is required, if two-man lift is required, whether vision is obscured while carrying and the walking surface and path where the object is to be carried.
- Get a co-worker to help if equipment or other item is too heavy to lift.
- If possible, use powered equipment instead of manually lifting heavy materials. Lifting equipment such as dollies, hand trucks, lift-assist devices, jacks, or carts can be provided for employees.
- Reduce lifts from shoulder height and from floor height by repositioning the shelf or bin to closer to the power zone.
- Make sure walkways are clear of tripping hazards before moving materials.
- Use your legs and keep your back in a natural position while lifting. Keep the load close to your torso.



- Test the load to be lifted to estimate its weight, size, and bulk and to determine the proper lifting method.
- Do not twist while carrying a load. Instead, shift your feet and take small steps in the direction you want to turn.
- Make sure there are appropriately marked and sufficiently safe clearances for aisles and at loading docks or passageways where mechanical-handling equipment is used.
- Properly stack loose or unboxed materials which might fall from a pile by blocking, interlocking, or limiting the height of the pile to prevent falling hazards.
- Bags, containers, bundles, etc. should be stored in tiers that are stacked, blocked, interlocked, and limited in height so that they are stable and secure to prevent sliding or collapse.

- Storage areas should be kept free from accumulation of materials that could lead to tripping, fire, or explosion.
- Work methods and stations should be designed to minimize the distance between the person and the object being handled.

Supervisors should periodically evaluate work areas and employees' work techniques to assess the potential for and prevention of injuries. New operations should be evaluated to engineer out hazards before work processes are implemented.

1.4 Regulations

OSHA does not have a standard which sets limits on how much a person may lift or carry. They do however state that lifting loads heavier than about 50 pounds will increase the risk of injury.

The National Institute for Occupational Safety and Health (NIOSH) has developed a mathematical model that helps predict the risk of injury based on the weight being lifted and other criteria. The NIOSH model is based on previous medical research into the compressive forces needed to cause damage to bones and ligaments of the back. The mathematical model is incorporated in the *Applications Manual for the Revised NIOSH Lifting Equation*, which can be found on the NIOSH website (http://www.cdc.gov/niosh/docs/94-110/). It should be noted, however, that this NIOSH document provides only voluntary guidelines.

If there is a situation that arises where an employee is required to perform manual lifting on a reoccurring basis, the NIOSH Lifting Equation will be used to determine the appropriate weight that employee can safely lift. The lifting equation establishes a maximum load of 50 pounds for employees that are less likely to have to lift something, and don’t have to do any long distance travel or maneuvering of the item. This 50 pounds is then adjusted to account for:

- how often the employee is lifting
- twisting the back during lifting
- the vertical distance the load is lifted
- the distance of the load from the body
- the distance the employee must move while lifting the load
- how easy it is to hold onto the load

GEI uses 50 pounds as a standard. However each individual should not attempt to carry loads heavier than they can safely manage.

1.5 Training

Training will include general principles of ergonomics, correct manual lifting techniques to avoid musculoskeletal injuries, recognition of hazards and injuries, procedures for reporting hazardous conditions, and methods and procedures for early reporting of injuries.

1.6 Lifting Assistance

If employees are assigned a task that involves repetitive lifting and carrying of equipment the Safety Team and Project Manager should be contacted to conduct an ergonomic evaluation. The task should be discussed to determine if there is an alternative method that can be used. The alternative method should institute an engineering or administrative control to reduce/limit the amount of lifting that is required of the employee. Some examples include providing smaller containers to reduce the weight of what needs to be lifted; providing a device that helps carry awkwardly-shaped objects easier; or using a winch, fork lift, or other device to lift the item(s) for the employee.

1.7 Injury Reporting

Injuries experienced during manual lifting activities should receive prompt medical attention. If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health and Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health & Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future musculoskeletal injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.8 Limitations

Follow safety procedures for manual lifting.

1.9 References

OSHA Technical Manual (OTM), Section VII: Chapter 1 - Back Disorders and Injuries
https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=29936 (Viewed 7/12/2016)
https://www.osha.gov/SLTC/etools/electricalcontractors/materials/heavy.html (Viewed 7/12/2016)

1.10 Attachments

None

1.11 Contact

Health&SafetyTeam@geiconsultants.com

1.12 Review History

- July 2016
- August 2014

STANDARD OPERATING PROCEDURES
SOP NO. HS-026 Hazard Identification and Management

1.1 Objective
This Standard Operating Procedure (SOP) is intended to outline the steps GEI employees will take to identify potential hazards on site, the risks associated with these hazards, and the proper engineering controls, work practices, and personal protective equipment (PPE) to use to minimize the associated risks.

1.2 Hazard Identification
Establishing proper work procedures by conducting a job hazard analysis will should be performed for all projects involving field work. An initial identification of hazards will be completed based on past and current property usage of the site, what tasks are required to perform the job, what equipment is needed to complete the assigned tasks, what hazards are in the working area etc.

The site-specific health and safety plan (HASP) will include a hazard assessment for the project that identifies the potential hazards and how to alleviate the hazard. These hazards will be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Risk Assessment
A risk assessment will be performed for all aspects of field work. This analysis is to determine the quantitative or qualitative value of risk related to a tangible situation and a recognized hazard. Identification, studies, and monitoring of any hazard to determine its potential, origin, characteristics, and behavior are examples of what could be included and performed during a risk assessment. The assessment will increase awareness of workplace hazards and provide an opportunity to identify and control workplace hazards.

1.3.1 Assessment Guidelines
It is necessary to consider certain general guidelines for assessing the foot, head, eye and face, and hand hazard situations that exist in an occupational operation or process, and to match the protective devices to the particular hazard.

Assessments should be conducted:

- Prior to starting any work at the site
- As conditions change
- Workplace layout changes
- Environmental changes
- Process changes

- Yearly or other pre-determined interval

1.3.2 Hazard Sources

Some examples of hazard sources include but are not limited to:

- Items, materials, or machinery in motion
- Extreme temperatures
- Chemical exposures
- Harmful dust
- Light radiation
- Falling objects or potential from dropping objects
- Sharp objects
- Rolling or pinching objects
- Layout of workplace and location of co-workers
- Electrical hazards
- Noise exposures
- Confined spaces
- Working near or on water
- Fall hazards
- Traffic or other activities taking place on the site
- Air quality issues

1.4 Prevention – Control Methods

Control methods should be considered in the following hierarchy:

- Elimination
- Substitution
- Engineering Controls
- Administrative Controls
- Personal Protective Equipment

1.4.1 Elimination and Substitution

Elimination and substitution, while most effective at reducing hazards, also tend to be the most difficult to implement in an existing process. If the process is still at the design or development stage, elimination and substitution of hazards may be inexpensive and

simple to implement. For an existing process, major changes in equipment and procedures may be required to eliminate or substitute for a hazard. Employees should work with the Safety Team to find solutions.

1.4.2 Engineering Controls

Engineering controls are used to remove a hazard or place a barrier between the work and the hazard. It's implemented to control the hazard at the source. Examples may include machine guards, sound deading/dampening panels, traffic barriers, guardrails, and shields.

1.4.3 Administrative Controls

Administrative controls change the work procedures such as programs, schedules, and supervision to reduce employee exposure to hazards. The controls are frequently used with existing processes where hazards are not particularly well controlled. Examples of administrative controls are requiring frequent breaks or implementing a specific method to perform a task.

1.4.4 Personal Protective Equipment Selection

To select the proper PPE, the potential hazards must be known. The protective equipment selected must ensure a level of protection *greater than* the minimum required in order to help protect employees. The user must be supplied with a properly fitting protective device and given instructions on care and use. Users must be aware of all warning labels for and limitation of the PPE. Employees must be aware that the PPE does not eliminate the hazard.

1.4.5 Hazard Re-Assessment

As necessary, the workplace should be re-assessed for hazards by identifying and evaluating new equipment and processes, reviewing accident records, and re-evaluating the suitability of previously selected PPE. Re-assessment should occur at a defined regular schedule interval.

1.5 Job Safety Analysis

A job safety analysis (JSA) sometimes referred to as a job hazard analysis (JHA) or an activity hazard analysis (AHA) is the breaking down of any method or procedure into its component parts to determine the hazards connected with each key step and the requirements for performing it safely.

When a JSA is being created, make sure it isn't too general where the resulting information is not enough to assess the hazard and select proper controls, and be careful not to add unnecessary steps.

1.6 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHS) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.7 Limitations

Limitations may arise on a project specific basis and will be addressed as they arise.

1.8 Attachments

None.

1.9 References

Risk Analytics, LLC Hazard Assessment Training Program, January 2011

1.10 Contact

Health&SafetyTeam@geiconsultants.com

1.11 Review History

- November 2016
- June 2015

STANDARD OPERATING PROCEDURES

SOP No. HS-029 Overtime and Fatigue Management

1.1 Objective

A consistent standard was developed for GEI Consultants, Inc. relative to overtime / fatigue management with the aim of reducing risk associated with worker fatigue, allow for sufficient sleep, and increase mental fitness in an effort to control employee turnover and absenteeism. The following guidelines will be followed when working extended hours or work shifts on GEI projects.

1.2 General

Extended or unusual work shifts may be more stressful physically, mentally, and emotionally. Non-traditional shifts and extended work hours may disrupt the body's regular schedule, leading to increased fatigue, stress, and lack of concentration. These effects lead to an increased risk of operator error, injuries and/or accidents.

Society is oriented toward traditional daytime work hours and work at night will often intensify fatigue and reduce alertness. Workers generally will not acclimate to night work, and sleep patterns will generally be disrupted so the non-work periods do not provide full recovery, resulting in sleep deprivation. Studies suggest that it can take up to 10 days to adapt to a night time work schedule.

Fatigue is a message to the body to rest. It is not a problem if the person can and does rest. However, if rest is not possible, fatigue can increase until it becomes distressing and eventually debilitating. The symptoms of fatigue, both mental and physical, vary and depend on the person and his or her degree of overexertion. Some examples include:

- weariness
- sleepiness
- irritability
- reduced alertness, lack of concentration and memory
- lack of motivation
- increased susceptibility to illness
- depression
- headache
- giddiness
- loss of appetite and digestive problems

Employees and Subcontractors will adhere to the following principles to address worker Overtime / Fatigue Policy:

- Maximum Number of Days in a 21-Day Window = Nineteen (19) days
- Number of Days off = Two (2) days
- Maximum Number of Hours in a Shift = Sixteen (16) Hours / Eighteen (18) hours with approval from
- GEI
- High Overtime Percentage = Overtime totaling more than 75% over a 40 hour work week
- High Overtime Period = last rolling 3 months

1.3 Training

Initial and annual training must be provided on how to recognize fatigue, how to control fatigue through appropriate work and personal habits, and reporting of fatigue to supervision. During training instructors will emphasize that proper sleep and nutrition can also help reduce worker fatigue.

1.4 Ergonomic Controls

Ergonomic equipment will be used to improve workstation conditions such as anti-fatigue mats for standing, lift assist devices for repetitive lifting, proper lighting and control of temperature, and other ergonomic devices as deemed appropriate (see GEI Safe Lifting SOP). Work tasks to control fatigue will be analyzed and evaluated periodically by GEI's health and safety staff. Assessments can be requested per GEI's Ergonomic Program. In addition, to reduce fatigue, chairs should be used by employees to sit periodically and take provide periodic rest breaks.

1.5 Safety Critical Positions

Employees identified as working in safety critical positions, such as working with hazardous materials or operating equipment, must report fatigue/tiredness and lack of mental acuity to their supervisors or Project Manager. In addition the Corporate Health and Safety Officer will be notified to make safety critical decisions and take appropriate actions to prevent loss.

1.6 Prescription and OTC Drug Use

Employees must not chronically use over-the-counter or prescription drugs to increase mental alertness. Employees should refrain from taking any substance known to increase fatigue in that employee, including fatigue that sets in after the effects of the drug wear off.

1.7 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.8 References

1.9 https://www.osha.gov/SLTC/emergencypreparedness/guides/extended.html

1.10 Attachments

None

1.11 Contact

Corporate Health & Safety Officer
East Regional Health & Safety Officer
South Regional Health & Safety Officer
Central Regional Health & Safety Officer
West Regional Region Health & Safety Officer

Appendix F

Con Edison Corporate Environmental, Health and Safety Procedures

- CEHSP E08.02 – Noise Construction and Utility Activities
- CEHSP S05.03 – Personal Protective Equipment – Protective Clothing
- CEHSP S12.00 – Lockout Tagout Procedures
- CEHSP S17.01 – Electrical Enclosed Spaces
- CEHSP A28.00 – Calling a Time Out
- CEHSP A32.00.01 – Rules We Live By, with 2015 (January 1, 2015) 'Rules' Table*
- Utility Clearance Process for Intrusive Activities – Corporate EH&S Remediation Program, Revision 1A, December 31, 2007
- Work Area Protection Field Manual

Final

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

CORPORATE ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURE

LAND USE

CEHSP E08.02 – Noise Construction and Utility Activities

Revision 7: 12/31/2014 Effective Date: 01/01/2015

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1.0 PURPOSE

IT IS THE POLICY OF CON EDISON TO COMPLY WITH STATE AND LOCAL REGULATIONS PERTAINING TO NOISE. The purpose of this procedure is to ensure that all company personnel perform appropriate actions to prevent ***unreasonable noise*** and comply with permissible noise limits.

2.0 APPLICABILITY

This Corporate Environmental, Health and Safety Procedure (CEHSP) applies to all Con Edison personnel and contractors, both on and off Con Edison facilities and at field locations, who attend to Con Edison equipment, facilities, or operations that create noise that could be considered unreasonable.

3.0 INTRODUCTION

New York City, and many local governments in the Company's service area have restrictions on the level of noise that may be produced. In general, these limits apply to two types of situations: ***facility operations***, and ***field operations***. In New York City, however, three distinct situations apply: ***facility operations***, construction activities and utility activities (street work). In addition, the restrictions vary by time of day. Con Edison has compiled tables summarizing the noise regulations applicable in the Company's service area. These tables can be found in Attachments *1* and *2*.

In addition, New York State regulations address noise from certain heavy duty trucks. These requirements are discussed in Section 4.4, New York State Noise Requirements.

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4.0 COMPLIANCE REQUIREMENTS

Equipment and operations associated with Con Edison facilities and services can produce noise. All equipment used by Con Edison should be in good working order, properly maintained, and properly used. Where possible, noisy equipment should not be located near ***noise-sensitive areas and/or sensitive receptors***, e.g., schools, hospitals, and churches.

Where a given operation could be accomplished using a variety of equipment, equipment with operating characteristics that produce less noise should be used. The facility or field manager is responsible for ensuring compliance with all federal, state and local noise regulations.

Qualified personnel should execute the procedures regarding noise measurements described in the following sections. Qualified personnel are defined as personnel from Con Edison Technical Service, who are trained to make noise measurements according to American National Standards Institute ***(ANSI)*** standards, and are operating under the advice from Con Edison's Environment, Health and Safety (EH&S) noise subject matter expert (SME). The person should be familiar with the make and type of equipment used in these measurements, calibration and should be experienced in general noise data collection procedures. The person should be able to identify ***impulsive*** and ***tonal noise.*** Measurements should be made using a Type 1 ***Sound Level Meter (SLM)*** / preamplifier/microphone combination.

4.1 FIELD OPERATIONS

Field operations include maintenance, installation, upgrade, and repair of Con Edison equipment. These types of operations include repair or installation of aboveground and belowground power transmission conduits (electrical, natural gas, steam), repair or installation of power transmission equipment, tree maintenance, on-site or off-site construction or demolition, and use of any safety equipment associated with these procedures.

Most field operations, other than operations undertaken outside of permissible times, can be thought of as construction activities. Construction activities additionally covered under this CEHSP include any activity (except tunneling) necessary or incidental to the erection, demolition, assembling, altering, installing, or equipping of buildings, public or private highways, roads, premises, parks, utility lines including such lines in already-constructed tunnels or other property, land clearing, grading, excavating and filling. Many communities have time restrictions on such activities, which must be adhered to. Additional requirements (discussed below), including the preparation of a Noise Mitigation Plan and additional sound-reducing devices, are required for work performed in New York City.

Unreasonable Noise

In addition to time restrictions, certain noise codes have specific regulations that must be followed regarding field activities. These regulations are summarized below.

- Construction devices – Prohibiting use of construction devices (e.g., air compressor, pile driver, bulldozer, crane, hoist) so as to create unreasonable noise.

- Containers and construction material – Prohibiting handling or transport of any container or any construction material in a public place so as to create unreasonable noise.

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- Exhausts - Except as otherwise provided in the New York City code, prohibiting discharge into the open air of the exhaust of any device, including but not limited to any steam engine, diesel engine, internal combustion engine or turbine engine, so as to create unreasonable noise.

- Power tools – Prohibiting use of power tools (e.g., nail guns, saws, vacuums, drills) so as to create unreasonable noise.

- Schools, hospital, courts – Prohibiting unnecessary noise through the use of any device on any street adjacent to any school or court while the same is in session, or adjacent to any hospital.

- Sensitive receptors – Prohibiting unnecessary noise through the use of any device within 50 feet of a school, house of worship, hospital, retirement community, open tract of serene land, park or recreation area, and psychiatric centers.

4.1.1 Utility Activities Within New York City

Negotiations with NYCDEP from 2005 to 2006 resulted in the partial exemption for utility-related construction, such as street activities, cable and pipe replacements, and new infrastructure installation.

Utility-related Construction must meet the following requirements:

- Each site where utility-related construction activities occur, or construction devices/tools are used, must have a filled-out Utility Noise Mitigation Plan on-site and posted. This requirement does not apply to safety devices utilized while performing routine maintenance task, such as ventilation blowers.

- OJT/Tailboard Talk training for all personnel who perform utility-related construction is required. Although our present CEHSP and GEIs satisfy this training requirement, additional training has been developed to assist with full compliance.

- The new code has restrictions on the types of tools that can be used, rather than list noise limits for each type as in the prior code requirements.

- Sensitive Receptors such as hospitals and schools adjacent to work locations should be communicated with prior to work starting when possible.

- For work longer than 3 days continuously in one location, postings and other communication must be sufficient to inform all residents within 200 feet of schedule.

Utility Noise Mitigation Plans

A utility noise mitigation plan template is included as *Attachment 3*. The utility noise mitigation plan should be filled out by the job supervisor or field foreman prior to the start of construction activities – only devices deemed in compliance with NYCDEP regulations shall be utilized. If there are any deviations from the approved items, the ConEd noise SME must be consulted prior to the start of work activities.

Elements of the utility noise mitigation plan include the following requirements:

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- Self-certification that tools/equipment maintained so they operate at normal manufacturer's operating specifications.
- Tools/equipment must be equipped with appropriate manufacturer's noise reduction device.
- Specialized vehicles require use of additional noise mitigation measures.
- Use of noise-insulating fabric for portable pumps, compressors, generators, etc.
- Quieter equipment shall be used when available or when required by the NYCDEP. Prohibit unnecessary engine idling.
- Properly install and secure steel traffic plates – must re-set and secure within 24 hours of a call from the DEP to the utility.
- Notify all residents within 200 feet of construction area when work is scheduled to be longer than 3 days.
- Notification shall include information on schedules/work locations.
- Respond to all noise complaints/official DEP notice on same day. If after hours, respond next day.
- Phase in vehicles with quieter backup alarms – already being done at ConEd.
- Establish / implement formal noise mitigation training program.
- Includes field supervisory personnel and subcontract supervisors.
- Supervisors shall field-train all field workers.
- Minimize noise impact of sensitive receptors.
- Schools, hospitals, places of worship, etc.
- Required to work with facility owner/operator.
- Perimeter ***noise barriers*** must be used in accordance with 28-101(g) of NYC Chapter 28.
- If project is non-emergency, long-term (greater than 15 days) where there is a dedicated lane, must comply with 28-100 through 28-104.

Permissible Hours of Utility Activities

Regulations concerning utility activities within New York City are listed below. All utility-related construction activities which fall outside these hours require after-hours authorization from the NYCDEP, the NYCDOB, or the NYCDOT. Additional noise mitigation methods may also be required if the NYCDEP so indicates for after-hours work.

Hours of Work are to be in accordance with NYC DOT permit stipulations and/or NYC DOT Highway Rules, generally 7 AM through 10 PM weekdays for utility activities. Please note the

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extension to 10 p.m., also applies to Con Edison's contractors. Additional mitigation techniques for receptors within 200 feet may be required by the DEP for hours between 10 PM and 7 AM during weekdays and 7PM through 7AM during weekends.

4.1.2 Construction Operations Within New York City

Construction Activities

General construction and demolition will have to meet the Utility requirements in addition to the following:

- More complex Mitigation Plans (must be completed as part of planning the work and prepared with the assistance of the noise SME)
- Specific mitigation requirements for a variety of tool/equipment types
- Certain activities may require enclosures/barriers to reduce noise
- Certain projects with perimeter construction fences shall be required to have noise attenuating material added to the fencing
- Quieter or "smart" back-up alarms are required.

Construction Noise Mitigation Plans

All construction work performed within New York City must be performed in accordance with NYC Administrative Code, Chapter 28. For all construction activities, a Noise Mitigation Plan (*Attachment 3*) must be completed. Only NYCDEP-approved devices or equivalent may be used on-site. NYCDEP must approve the plan, however would pre-approve generic plans with checklists for certain repetitive work. Consult with the Corporate Environmental Health and Safety Department for assistance.

The Mitigation Plan must be written and clearly posted at the job site. Elements of the construction and demolition noise mitigation plan include the following requirements:

- More complex Mitigation Plans (must be completed as part of planning the work and prepared with the assistance of the noise SME)
- Residents within 200 feet of a construction site shall be given notice when work is scheduled for longer than 3 days. Conspicuous posting of such information, or where necessary notification of building managers/owners, shall satisfy this requirement.
- The owner/operator of sensitive receptors (e.g. schools, hospitals and places of worship), adjacent to this site, shall be contacted when practicable to coordinate work to minimize impact on the property.
- Self-certification that tools are maintained so that they operate at normal manufacturer's operating specifications. The NYCDEP will refer to an outside source to determine if your equipment "may be the source of a noise complaint".

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- Use of mufflers/noise mitigation devices on equipment and construction vehicles to meet requirements. *(Note: If equipment continues to exceed level as specified in the Appendix of Rules, a five day cure periods is allowed to perform maintenance, replace equipment and file an Alternative Noise Mitigation Plan.)*

- Mitigation of noise from internal combustion engines.

- Prevention of vehicle idling and use of quieter backup alarms.

- Use of noise barriers if site is within 75 feet of a residential receptor or 200 feet of ANY receptor.

- By January 1, 2008, quieter or "smart" back-up alarms will be required.

- Construction projects that are not regard as "utility work" (e.g. building construction or demolition, major renovation, or any installations) that are not completed within **15 calendar days**, will not fall under the same exemption as work on the system.

- Construction material shall not be handled in such a way as to create unreasonable noise.

Permissible Hours of Construction

Regulations concerning construction activities within New York City are listed below. All construction activities which fall outside these hours require after-hours authorization from the NYCDEP, the NYCDOB, or the NYCDOT. Additional noise mitigation methods (such as noise barriers) are required if work is performed outside these hours.

Hours of Work are to be in accordance with NYC DOT Permit Stipulations and/or NYC DOT Highway Rules, generally 7 AM through 6 PM weekdays for construction activities. Additional mitigation techniques for receptors within 200 feet may be required by the DEP for hours between 7 PM and 7 AM during weekdays and during weekends. There is an exception for occupied one or two family dwellings, convents or rectories between 10 a.m. and 4 p.m. on wither Saturday or Sunday (Note: Must be a minimum of 300 feet from house of worship).

4.1.3 Operations Outside New York City

Permissible Hours of Construction

Regulations concerning normal field operations are listed in the table in *Attachment 1*, Normal Field Operation Regulations. Except where indicated, these are simply day and time restrictions imposed by the various communities. In many cases, providing that field operations do not occur outside these day and time restrictions, the field operations will be in compliance with the local noise codes.

Specific Requirements

Some noise codes require special muffler requirements on devices such as engines, air compressors, and pavement breakers. In addition, certain communities impose noise limits on construction activities. If there are specific noise levels stated in the Special Requirements column of the table in *Attachment 1*, noise monitoring may be required. Careful attention should be given to the equipment and vehicles used in field operations utilizing impact equipment that

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emit high impulsive noise levels such as pile drivers, pavement breakers, and steam shovels. [6] P

The following procedures apply only to field operations that require noise monitoring as indicated in *Attachment* 1 and may be skipped if no special requirements are listed in Attachment 1.

4.2 OPERATIONS UNDERTAKEN OUTSIDE OF PERMISSIBLE TIMES

In some jurisdictions, noise from operations undertaken outside of permissible times as a result of dealing with emergency situations is exempt from local noise restrictions. However, some jurisdictions impose time limits on such operations, may require a variance for such operations, and/or may require repair operations to commence within a certain time limit of the ***emergency event***. NYC may issue variance from noise standards for the construction activity. Variance may be granted for the initial period of three days and then renewed. The variance must be clearly posted. If work must begin without variance, an application must be submitted within ***12*** **hours** of commencement.

4.2.1 Utility Activities Within New York City

For utility work conducted outside of 7AM – 10 PM on weekdays, additional authorization must be obtained from NYCDOB, NYCDOT or NYCDEP to work outside those hours. From 6PM – 10PM weekdays, any required daytime noise mitigation controls must be utilized. From 10PM – 7AM weekdays and 7PM – 7AM weekends, additional noise mitigation controls may be required by the DEP if there are any receptors within 200 feet. This will be determined on a case-by-case basis.

4.2.2 Construction Operations Within New York City

In New York City, in the case of urgent necessity in the interest of public safety, the NYCDEP is authorized under the New York City Noise Code to issue a variance from the provisions of the Construction Activity Noise Code provisions for any such construction activity. Such a variance may be granted for an initial period of up to 3 days, and may be renewed for periods of 3 days or less while such urgent necessity continues. The variance must be clearly marked on the license or permit, which must be prominently posted at the job site.

4.2.3 Operations Outside New York City

Refer to the Noise Regulations for Operations Undertaken Outside of Permissible Times (*Attachment 4*), for any required variances, time limitations, and exemptions regarding operations undertaken outside of permissible times. [8] R/P

4.3 NOISE MONITORING METHODOLOGY

The noise measuring device should be set to use the descriptor specified in the local noise code, as indicated in Special Requirements column of the *Attachment* 1. Noise that is considered impulsive must be noted and used in the evaluation of the maximum allowable levels given in *Attachment 3*, the Normal Field Operation Regulations Table. Measurements should be made in such a way as to exclude ***extraneous noises***. Measurements should not be made while ***adverse meteorological conditions*** are occurring in the study area.

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Repeat this procedure for each boundary at the property line. Compare the measured property line levels with the maximum allowable levels for the corresponding area in *Attachment* 1. If measured noise levels are below the maximum allowable noise levels for the corresponding types of noise, as indicated in the Special Requirements column of (*Attachment* 1), then noise levels from the Normal Field Operations meet the requirements of the local noise code. If measured levels exceed the maximum allowable levels, the noise from l field operations exceeds the local noise codes. [7]

New York City no longer requires noise measurements for normal field locations. Use ***A-weighted*** measurements. All measurements must be taken by "qualified personnel" only.

5.0 DEFINITIONS

Adverse Meteorological Conditions: Rain, snowfall, snow-covered ground, wet ground, gusty winds, and high winds. Measurements should not be made during these types of conditions.

ANSI: Acronym for "American National Standards Institute".

A-Weighted: Measurement that assigns each frequency a "weight" through the use of a filter network that is related to the sensitivity of the ear at that frequency. The level of the filtered signal is displayed as the A-weighted level. The A-weighted frequency characteristic was originally designed to mirror the 40-phon equal-loudness-level contour of the 1933 Fletcher-Munson data.

Emergency Event: The need for immediate repair of Con Edison equipment associated with Con Edison operations due to situations that are causing or are likely to cause service interruptions, or situations that present an imminent danger to the public. Examples include repair or installation of aboveground and belowground power transmission conduits (e.g., electrical, natural gas, steam), immediate repair or installation of power transmission equipment, and immediate tree maintenance.

Extraneous Noises: Noises that are not associated with Con Edison operations. Extraneous noises include, but are not limited to, passing automobiles or trucks, railway activity, nearby aircraft, nearby construction or demolition, natural sounds, and other nearby noises not associated with Con Edison operations.

Facility Operations: Operational procedures of Con Edison facilities which are essential for normal Con Edison operations. Examples include power generation, compressors, turbines, pipes and valves, bulk material transport, deliveries, fans, and any on-site maintenance or modifications.

Field Operations: Maintenance, installation, upgrade, and repair of Con Edison equipment associated with Con Edison operations. Examples include repair or installation of aboveground and belowground power transmission conduits (e.g., electrical, natural gas, steam), repair or installation of power transmission equipment, tree maintenance, and on-site construction or demolition.

Impulsive Noise: A single short burst or a series of short bursts of sound pressure. The pressure-time history of a single burst includes a rise to peak pressure, followed by a decay of the pressure envelope. The pressure-time history of a single burst includes a 6 dB, or greater, rise to peak pressure, followed by a decay of the pressure envelope, when the rise to peak

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pressure occurs in 1 second or less. For noise containing a series of short bursts of sound pressure, the noise will be considered impulsive if each impulse in the series is separated in time by less than 1 second. Examples include thunder, noise as a result of pile-driving, steam-shoveling, etc.

Noise Barrier: A structure used for the purpose of placing near a noise source to reduce the noise level measurable at a receptor location.

Noise-Sensitive Area (a.k.a Sensitive Receptor): Tracts of land where serenity and quiet are extraordinarily important and serve an important public need, and where the preservation of these qualities is essential for the area to serve its intended purpose. Such areas could include amphitheaters, particular parks, or portions of parks or open spaces dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet. Examples are grounds for ambulatory hospital patients and patients and residents of sanitariums and old-age homes.

Octave Band: A filter with a single transmission band or passband with relatively low attenuation extending from a lower band-edge frequency greater than zero to a finite upper edge frequency which is twice the lower band-edge frequency. The nominal midband frequency, for a set of contiguous octave bandpass filters, is one of a series that includes 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 hertz, extended by successive multiplication or division by 10.

Qualified Personnel: Personnel from Con Edison Technical Service, who are trained in calibrated noise measurements and calibrated ***octave band*** measurements, according to ANSI standards, and are operating under the advice from Con Edison EH&S. Qualified personnel should be familiar with the make and type of equipment used in the measurements, and experienced in general noise data collection procedures. Qualified personnel should be able to identify impulsive and periodic noise.

Receptor: Real property, including but not limited to buildings, grounds offices and dwelling units, from which sound levels from sound sources outside such property may be measured.

Sound Level Meter (SLM): Device used to measure sound pressure level with a standardized frequency weighting and indicated exponential time weighting for measurements of sound level, or without time weighting for measurement of time-average sound pressure level or sound exposure level.

Tonal Noise: For the purposes of this document, noise containing single-frequency tones, when the sound pressure of any single-frequency tone in any octave band exceeds the non-tonal masking noise in the corresponding octave band by 6-dB or more. This corresponds, in general, to a tone being prominent when it is more than 10 dB above the threshold of audibility. Examples of tonal noise would include transformer hum, idling engine noise, and constant-rpm engine noise.

Unreasonable Noise: Any excessive or unusually loud sound that annoys, disturbs, injures, or endangers the comfort, repose, health, peace, or safety of a person or that causes injury to plant or animal life, or damage to property or business.

6.0 REFERENCES

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NOTE: Con Edison is subject to numerous local noise regulations. For guidance, tables have been developed summarizing these local noise regulations applicable in Con Edison's service area. These tables include:

- Attachment 1, Field Operation Regulations
- Attachment 4, Noise Regulations for Operations Undertaken Outside of Permissible Time

For purposes of the References section, the annotations are limited to citations to New York City and New York State regulations. Readers are referred to the Tables for local requirements.

Note: Regulations are subject to change without notice, especially local noise regulations. For compliance with local regulations, please confirm with Law as needed. References are forthcoming.

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REVISION HISTORY

Revision Date	Revision #	Summary of Change	Author
12/310/2014	7	Periodic review completed with one minor note added to the reference section. "*Regulations are subject to change without notice, especially local noise regulations. For compliance with local regulations, please confirm with Law as needed*"	S. Mahoney

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ATTACHMENT 1
FIELD OPERATION REGULATIONS

CITY, TOWN or VILLAGE	ALLOWABLE NORMAL OPERATION DAYS/HOURS	SPECIAL REQUIREMENTS
Airmont	Mon-Sat 8:00am-10:00pm	L_{10} (1) levels must not exceed 60dB(A) at construction site boundary
Beacon	7:00am-11:00pm	
Briarcliff Manor	Mon-Sat 8:00am-7:00pm	Blasting and Rock Drilling permitted only Mon-Fri 9:00am-5:00pm
Bronxville	Mon-Fri 8:00am-6:00pm	
Buchanan (Village of)	8:00am-7:00pm	
Chestnut Ridge (Village of)	Mon-Sat 8:00am-7:00pm	L_{10} (1) levels must not exceed 60dB(A) at construction site boundary
Clinton	7:00am-8:00pm	
Croton on Hudson	Mon-Sat 8:00am-10:00pm Sundays 10:00am-8:00pm	
Dover	7:00am-9:00pm	
Greenburg	Mon-Fri 7:00am-8:00pm Sat 9:00am-6:00pm; no work on Sunday	
Hyde Park	6:00am-11:00pm	
LaGrange (Town of)	6:30am-9:00pm	
Larchmont	Mon-Fri 8:00am-7:00pm Sat 9:00am-6:00pm Sun 10:00am-5:00pm	L_{10} (1) levels must not exceed 70dB(A) at a distance of 40 feet
Lewisboro	Mon-Sat 8:00am-7:00pm	
Mamaroneck	Mon-Fri 8:00am-8:00pm Sat 9:00am-6:00pm Sun 9:00am-5:00pm	Pile Drivers and Steam Shovels permitted only Mon-Fri 8:00am-6:00pm No noise permitted beyond property border
Millbrook (Village of)	7:00am-10:00pm	Hours of restriction only apply when within 500 feet of residential zone.
Montebello	Mon-Sat 8:00am-10:00pm	L_{10} (1) levels must not exceed 60dB(A) at construction site boundary
Mount Pleasant	8:00am-6:00pm	• L_{10} (1) levels must not exceed 70dB(A) at a distance of 400 feet when bordering residential zone from 8:00am-6:00pm. • L_{10} (1) levels must not exceed 55dB(A) at a distance of 400 feet when bordering residential zone from 6:00pm-8:00am. • L_{10} (1) levels must not exceed 75dB(A) at a distance of 400 feet bordering nonresidential zone during business hours. • L_{10} (1) levels must not exceed 80dB(A) at a distance of 400 feet bordering nonresidential zone during nonbusiness hours.
Mount Vernon	Mon-Fri 7:00am-6:00pm No weekends permitted unless have current permit from the Committee of Buildings	• L_{10} (1) levels must not exceed 70dB(A) at 400 feet when bordering residential zone from 8:00am-8:00pm. • L_{10} (1) levels must not exceed 55dB(A) at 400 feet when bordering residential zone from 8:00pm-8:00am. • L_{10} (1) levels must not exceed 75dB(A) at 400 feet when bordering commercial zone during business hours. • L_{10} (1) levels must not exceed 75dB(A) at 400 feet when bordering commercial zone during non-business hours. • Sound levels must not exceed 80dB(A) at the site boundary when bordering a manufacturing zone. • Sound levels must not exceed 55dB(A) at site boundary when near any noise-sensitive areas.

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ATTACHMENT 1 (CONTINUED)
FIELD OPERATION REGULATIONS

CITY, TOWN or VILLAGE	ALLOWABLE NORMAL OPERATION DAYS/HOURS	SPECIAL REQUIREMENTS
New Castle	Mon-Fri 7:30am-8:00pm Sat-Sun 10:00am-5:00pm	No blasting on Saturday, Sunday or holidays
New Rochelle (Residential)	Mon – Fri 8:00am-10:00pm Sat-Sun 10:00am-5:00pm 10:00pm-8:00am	• L_{10} (1) levels must not exceed 70dB(A) at a distance of 400 feet in residential areas. • Sound levels must not exceed 55dB near any sensitive receptor. • Compressors require mufflers with 20dBA or more Insertion Loss. • Pavement Breakers manufactured before 12/31/74 require mufflers with 5dBA or more Insertion Loss. • For residential areas, no noise must be audible beyond property perimeter.
New Rochelle (Commercial)		L_{10} (1) levels must not exceed 75dB(A) at a distance of 400 feet during normal business hours L_{10} (1) levels must not exceed 80dB(A) at a distance of 400 feet at all other times In manufacturing areas, during a 24hour period, L_{10} (1) levels must not exceed 80 dB(A) when measured at construction site boundary
New York City	Mon-Fri 7:00am-6:00pm	
North Castle	8:00am-6:00pm(or sundown) Sundown – 8:00am	• Sound levels must not exceed 70dB(A) at a distance of 400 feet when bordering residential zone. • Sound levels must not exceed 75dB(A) at a distance of 400 feet when bordering commercial zone. • Air Compressors require mufflers with 20 dBA or more Insertion Loss. • Paving Breakers manufactured before 12/31/74 require mufflers with 5 dBA or more Insertion Loss. • Sound levels must not exceed 55dB(A) in residential areas or 65dB(A) in commercial / manufacturing areas
North Hempsted (Village of)	Mon-Fri 8:00am-9:00pm Sat-Sun 10:00am-6:00pm	
Ossining (Town of)	Mon-Fri 8:00am-8:00pm Saturday 9:00am-5:00pm	
Ossining (Village of)	Mon-Fri 7:30am-8:00pm Saturday 9:00am-5:00pm	
Pawling (Village of)	Mon-Sat 7:00am-8:00pm	L_{10} (1) levels must not exceed 80dB(A) at construction site boundary. IMPULSIVE Noise must not exceed 130dB(A) at property line.
Peekskill	Mon-Fri 7:30am-8:00pm Saturday 9:00am-5:00pm	No holiday work permitted
Piermont	7:00am-5:00pm	
Poughkeepsie (City)	6:30am-9:00pm	Other hours for construction (emergency work) only with a permit issued by the Building Inspector
Poughkeepsie (Town)	7:00am-10:00pm	
Ramapo	Mon-Sat 8:00am-10:00pm	L_{10} (1) levels must not exceed 60dB(A) at construction site boundary

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CITY, TOWN or VILLAGE	ALLOWABLE NORMAL OPERATION DAYS/HOURS	SPECIAL REQUIREMENTS
Sleepy Hollow (Village of)	Mon-Fri 8:00am-9:00pm Saturday 9:00am-9:00pm	
Sloatsburg	Mon-Fri 7:00am-7:00pm	
Suffern	Mon-Fri 7:00am-8:00pm	
Unionvale	7:00am-8:00pm	
West Haverstraw	Mon-Fri 6:00am-9:00pm Saturday 8:00am-22:00pm	
White Plains	7:00am-7:00pm	
Yonkers	Mon-Fri 7:00am-9:00pm	

L_{eq}(1): Time-average sound energy level during a time period of 1 hour. For the purposes of this document, all $L_{eq}(1)$ levels are expressed in dB(A).

L_{10}: The sound level exceeded for 10% of the specified time period.
L_{90}: The sound level exceeded for 90% of the specified time period.

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ATTACHMENT 2

Effective July 1, 2007, the NYCDEP Noise Code is updated to include additional construction requirements. A section of the new code specifically exempts utility-related streetwork and similar utility maintenance work from many of the requirements, but Con Edison and its contractors and subcontractors will still have several new requirements (NOTE: vendors should use same form as Con Edison but enter their name and contact number and cross out ours). Existing requirements will likely receive new emphasis. A posted Noise Mitigation Plan will be required on construction sites.

A compilation of construction noise requirements follows.

1) Most of our streetwork will be construction work, with the exception of routine manhole entries and other activities that do not involve construction tools or equipment. **Routine manhole work where the only devices utilized are a blower for atmospheric ventilation and/or an electric water pump inside the structure would not be considered construction work.**

2) The most current version of the attached form "Utility Noise Mitigation Plan" must be filled out and posted with the permit or elsewhere at the site, and presented to an inspector during a visit.
   NOTE: Post as soon as possible for emergencies.

3) Job briefing and/or tailboard talks should include this page and the Mitigation Plan.

4) The form includes lines for company name, contact number, and work schedule. Copies of the form have had contact information filled out already, and the schedule is usually on the permit. Emergencies and short-duration work will not require a schedule.

5) The form needs to indicate whether certain equipment will be used, and for jackhammers what type we are using. Check off or circle anything to be used for the job. "Backup" is not applicable at this time.

6) Portable pumps, compressors, and generators must be placed to minimize noise on nearby residents. Watch exhaust direction, as noise is louder in the direction of the exhaust.

7) As is currently required, all equipment/devices must have the manufacturer mufflers and other noise reduction parts in place, and be in good working order.

8) If NYCDEP concludes in response to a noise complaint that **properly used and maintained** equipment /devices are too loud, we will have 5 days to provide quieter models, alter our work, or file a variance.

9) When work is adjacent to **sensitive receptors**, such as schools, places of worship, retirement housing, or hospitals, attempt to contact and coordinate with the facility to minimize noise impact on activities.

10) When work extends past 3 days in the same location, the schedule must be posted conspicuously to inform nearby residents within 200 feet, or contact building owner(s).

11) Report all contact with NYCDEP noise enforcement to your supervisor or EH&S immediately.

12) As is currently required, minimize vehicle idling and ensure road plates are secure.

Utility Noise Mitigation Plan

v.2 7/31/12

I. Contact Information

Name of Responsible Party as defined in 15RCNY §28-109(a) (Utility and/or Contractor and/or Sub):

Consolidated Edison -or-_____

Contact Phone Number 1-800-75CONED -or-_____

Work Schedule_____

DOT Permit (if needed)_____

Unless work duration is undetermined or anticipated to be only one shift, then fill in work in I above. For variances from permit or long-term emergencies, fill in work location/schedule above if known.

Permits need not be posted for emergency response and for routine manhole work in accordance with NYC DOT and NYC DEP rules and regulations. Emergency work may commence immediately and within 3 days, a permit and copy of this Plan shall be posted.

II. Site-Specific Information

Hours of Work are to be in accordance with NYC DOT Permit Stipulations and/or NYC DOT Highway Rules. Additional mitigation techniques for receptors within 200 feet may be required by the DEP for hours between 10 PM and 7 AM during weekdays and 7PM and 7 AM during weekends.

Residents within 200 feet of a construction site shall be given notice when work is scheduled for longer than 3 days. Conspicuous posting of such information, or where necessary notification of building managers/owners, shall satisfy this requirement.

The owner/operator of **sensitive receptors**, adjacent to this site, shall be contacted when practicable to coordinate work to minimize impact on the property.

Vehicle **engine idling** shall be prevented in accordance with NYC Ad. Code §24-163.

All **street plates** at this site, shall be installed and properly secured in accordance with 34RCNY §2-11(10)(e)

All corrective actions, at this site, shall be taken within **24 hours** of notice by the DEP or its agent.

All rules of 28RCNY §106 apply.

III. Construction Devices

This Plan certifies that all equipment indicated in this Mitigation Plan is maintained to operate in accordance with the manufacturer's operating specifications and has been equipped with appropriate manufacturer's noise reducing devices.

Check applicable boxes below:

When the specific devices listed in next column are utilized, the use of barriers is not required unless the Dept. of Environmental Protection receives complaints. NOTE: All devices must have manufacturer's noise reduction device installed and properly functioning. NOTE: Small electric sump pumps inside structures and blowers for atmospheric ventilation are safety devices, not construction devices.

☐ **JACKHAMMERS (including chisel hammer attached to a vehicle like a backhoe)**
- ☐ Copco model TEX P90S with elongated muffler casing or bellows > 15 inches in length (or equivalent)
- ☐ **Chicago Pneumatic CP1240 with a model F-814004 muffler (or equivalent)**
- ☐ Other _____

☐ BACKHOES _____ method of mitigating device

☐ GENERATORS (Noise mitigation required – noise insulating fabric or other such techniques)

☐ COMPRESSORS (Noise mitigation required – noise insulating fabric or other such techniques)

☐ PUMPS (Noise mitigation required – noise insulating fabric or other such techniques)

☐ OTHER_____

IV. Specialized Equipment: Circle applicable device

The vehicles listed below and other vehicles with internal combustion motors shall require noise mitigation measures as specified by the DEP, such as the use of noise-insulating material or other such techniques that do not interfere with engine operation. The location of receptors should be considered in the placement and use to minimize noise impact.

Rodding or Cable Truck **Flush / Vac Truck**

Pavement Core Drilling Truck **Vacuum Excavator Truck**

Indicate method(s) of mitigating any of the above devices:_____

☐ BACKUP ALARMS (Required January 2008)
- ☐ Preco Model 45AA (or equivalent)
- ☐ Ecco Model 820 (or equivalent)
- ☐ Preco Model 1048 (or equivalent)
- ☐ Ecco Model SA907 (or equivalent)
- ☐ Grote Model 73100 (or equivalent)
- ☐ BBS-TEK Brigade Model BBS-92 (or equivalent)

Version 2, July 3, 2007

You must use the latest version available. Please check the website: http://www.nyc.gov/html/dep/html/airnoise.html

Utility Noise Mitigation Plan

v.2 7/31/12

I. Contact Information

Name of Responsible Party as defined in 15RCNY §28-109(a)
(Utility and/or Contractor and/or Sub):

_____

Contact Phone Number_____
Work Schedule_____
DOT Permit (if needed)_____

Unless work duration is undetermined or anticipated to be only one shift, then fill in work in I above. For variances from permit or long-term emergencies, fill in work location/schedule above if known.

Permits need not be posted for emergency response and for routine manhole work in accordance with NYC DOT and NYC DEP rules and regulations. Emergency work may commence immediately and within 3 days, a permit and copy of this Plan shall be posted.

II. Site-Specific Information

Hours of Work are to be in accordance with NYC DOT Permit Stipulations and/or NYC DOT Highway Rules. Additional mitigation techniques for receptors within 200 feet may be required by the DEP for hours between 10 PM and 7 AM during weekdays and 7PM and 7 AM during weekends.

Residents within 200 feet of a construction site shall be given notice when work is scheduled for longer than 3 days. Conspicuous posting of such information, or where necessary notification of building managers/owners, shall satisfy this requirement.

The owner/operator of **sensitive receptors**, adjacent to this site, shall be contacted when practicable to coordinate work to minimize impact on the property.

Vehicle **engine idling** shall be prevented in accordance with NYC Ad. Code §24-163.

All **street plates** at this site, shall be installed and properly secured in accordance with 34RCNY §2-11(10) (e)

All corrective actions, at this site, shall be taken within **24 hours** of notice by the DEP or its agent.

All rules of 28RCNY §106 apply.

III. Construction Devices

This Plan certifies that all equipment indicated in this Mitigation Plan is maintained to operate in accordance with the manufacturer's operating specifications and has been equipped with appropriate manufacturer's noise reducing devices.

Check applicable boxes below:
When the specific devices listed in next column are utilized, the use of barriers is not required unless the Dept. of Environmental Protection receives complaints. NOTE: All devices must have manufacturer's noise reduction device installed and properly functioning. NOTE: Small electric sump pumps inside structures and blowers for atmospheric ventilation are safety devices, not construction devices.

☐ **JACKHAMMERS (including chisel hammer attached to a vehicle like a backhoe)**
- ☐ Copco model TEX P90S with elongated muffler casing or bellows > 15 inches in length (or equivalent)
- ☐ **Chicago Pneumatic CP1240 with a model F-814004 muffler (or equivalent)**
- ☐ Other _____

☐ BACKHOES _____ method of mitigating device
☐ GENERATORS (Noise mitigation required – noise insulating fabric or other such techniques)
☐ COMPRESSORS (Noise mitigation required – noise insulating fabric or other such techniques)
☐ PUMPS (Noise mitigation required – noise insulating fabric or other such techniques)
☐ OTHER _____

IV. Specialized Equipment: Circle applicable device

The vehicles listed below and other vehicles with internal combustion motors shall require noise mitigation measures as specified by the DEP, such as the use of noise-insulating material or other such techniques that do not interfere with engine operation. The location of receptors should be considered in the placement and use to minimize noise impact.

Rodding or Cable Truck **Flush / Vac Truck**

Pavement Core Drilling Truck **Vacuum Excavator Truck**

Indicate method(s) of mitigating any of the above devices: _____

☐ BACKUP ALARMS (Required January 2008)
- ☐ Preco Model 45AA (or equivalent)
- ☐ Ecco Model 820 (or equivalent)
- ☐ Preco Model 1048 (or equivalent)
- ☐ Ecco Model SA907 (or equivalent)
- ☐ Grote Model 73100 (or equivalent)
- ☐ BBS-TEK Brigade Model BBS-92 (or equivalent)

Version 2, July 3, 2007
You must use the latest version available. Please check the website: http://www.nyc.gov/html/dep/html/airnoise.html

ATTACHMENT 3
CONSTRUCTION MITGATION PLAN

The most recent form may be downloaded at

http://www.nyc.gov/html/dep/html/noise/index.shtml

ATTACHMENT 4
NOISE REGULATIONS FOR OPERATIONS UNDERTAKEN OUTSIDE OF PERMISSIBLE TIME

CITY, TOWN, or VILLAGE	Regulations	DETAILS
Bedford	EXEMPT	
Airmont (Village of)	EXEMPT	
Chestnut Ridge (Village of)	EXEMPT	
Clinton (Town of)	EXEMPT WITH APPROVAL	Granted by Zoning Enforcement Officer and the Zoning Board of Appeals
Croton-on-Hudson	EXEMPT	
Dover (Town of)	ONLY FOR TEMPORARY CONDITIONS	
Fishkill (Town of)	BY TEMPORARY PERMIT	Granted by Town Clerk upon recommendation of Zoning Enforcement Officer
Hastings-on-Hudson	EXEMPT	
Hyde Park (Town of)	EXEMPT	
LaGrange (Town of)	EXEMPT	
Mamaroneck (Town of)	ONLY WITH EXCEPTION	Issued by Town of Mamaroneck
Mamaroneck (Village of)	SPECIAL PERMIT REQUIRED	Issued by Building Inspector
Millbrook (Village of)	EXEMPT	
Montebello (Village of)	EXEMPT	
Mount Pleasant	SPECIAL PERMIT REQUIRED	Issued by Building Inspector
Mount Vernon	SPECIAL PERMIT REQUIRED	Issued by Commissioner of Buildings
New Castle	VARIANCE REQUIRED	Issued by Zoning Board of Standards and Appeals
New Hempstead (Village of)	EXEMPT	
New Rochelle	PERMIT FOR RELIEF REQUIRED	Issued by City Clerk
New York City	VARIANCE REQUIRED	Within 12 hours, Variance Required. Variance Valid for 3 days, and must be renewed as required. Mitigation Plan required.
North Castle	SPECIAL PERMIT REQUIRED	Issued by Building Inspector
Nyack (Village of)	EXEMPT	
Pawling (Village of)	EXEMPT	
Piermont (Village of)	VARIANCE REQUIRED	Issued by Village Board
Poughkeepsie (City)	SPECIAL PERMIT REQUIRED	Issued by Building Inspector, valid for up to 3 days. May be renewed for an additional 3 days.
Poughkeepsie (Town of)	EXEMPT	
Ramapo (Town of)	EXEMPT	
Scarsdale	EXEMPT	
Sleepy Hollow	EXEMPT	
Spring Valley (Village of)	SPECIAL	Exempt for 24 hours
Suffern (Village of)	EXEMPT	
Wappingers Falls (Village of)	EXEMPT	
West Haverstraw (Village of)	SPECIAL PERMIT REQUIRED	Issued by Building Inspector for periods of 3 days. May be renewed.
Yonkers	EXEMPT	

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
CORPORATE ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURE

CEHSP S05.03 – Personal Protective Equipment: Protective Clothing
Revision 11: 06/30/2015 Effective Date: 07/31/2015

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1.0 PURPOSE

IT IS THE POLICY OF CON EDISON TO COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS PERTAINING TO THE SELECTION OF PROTECTIVE CLOTHING FOR THE BODY (ARMS, LEGS, AND TORSO). The purpose of this procedure is to ensure that appropriate ***personal protective equipment (PPE)*** is selected and worn to protect Con Edison workers, contractors, and visitors at Con Edison facilities and work sites from chemical and physical hazards to the ***body***.

2.0 APPLICABILITY

This Environmental, Health and Safety Procedure (CEHSP) applies to any Con Edison activity that presents work hazards to the body that require the use of PPE.

3.0 INTRODUCTION

Many hazards can threaten the body, including heat, splashes from hot metals during welding, splashes from hazardous liquids (acids, bases, solvents), impacts, cuts, electrical hazards (arc, flame), and radiation. Based on the results of ***hazard assessments*** performed in each facility in accordance with CEHSP S 05.01, *Hazard Assessment and Personal Protective Equipment*, protective clothing must be identified that provides the correct protection.

Where hazards are determined to be present that can cause injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact, it is necessary to select PPE to adequately protect affected employees. A variety of protective clothing is available to protect against these hazards, including vests, jackets, aprons, coveralls, and full-body suits. In

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addition, the OSHA Electrical Maintenance Standard, 29 Code of Federal Regulations (CFR) 1910.269 and Subpart V, requires generation, transmission, and distribution workers who may be exposed to flame or electric arc to wear clothing that will provide enough protection to prevent burns exceeding first degree.

This procedure presents requirements for selecting and maintaining protective clothing to control work hazards to the body, specifically the arms, legs, and torso.

4.0 COMPLIANCE REQUIREMENTS

4.1 HAZARD ASSESSMENT AND GENERAL GUIDELINES FOR SELECTION AND USE OF PPE

Con Edison must perform a hazard assessment to determine the ***proper*** personal protective equipment required for each job task performed by employees. The hazards, physical requirements of the operation, resistance of clothing to work-related destructive factors (chemicals, abrasion, etc.), and worker comfort must be considered when selecting required clothing. The PPE hazard assessment is performed to ensure that PPE is correctly identified and that implementation is consistent with workplace conditions. The assessment must be reviewed when new PPE or new chemicals are introduced into the workplace or when operations change. A ***hazard assessment certification*** must be maintained by personnel and the facility to provide a record of workplace reviews. [1] R

The following paragraphs identify guidelines for the selection and use of protective clothing.

4.1.1 Arc or Flame Protection

OSHA standard 29 CFR 1910.269 and Subpart V requires that all electric power generation, transmission, and distribution workers who may be exposed to arc or flames wear clothing that will provide enough protection to prevent burns exceeding first degree.

4.1.2 Fit and Appearance

Clothing of all kinds must meet certain safety requirements when there is a potential for it to catch on moving parts of machinery (gears, pulleys, rotating shafts, etc.). Clothing, whenever practical, must not have loose parts, such as sleeve tabs, pant cuffs, pocket flaps, etc. Sleeves or pant legs must fit closely to the wearer.

When appropriate, the color of the garment selected must be chosen to show stains that could indicate contact with a hazardous substance or to make a worker conspicuous. Also, persons working in areas near traffic must wear fluorescent yellow/reflective vests as specified in the Con Edison Work Area Protection and Traffic Control Field Manual. [3] R/P

4.1.3 Laundering

Maintenance and laundering are needed when clothing is soiled due to ***incidental contact*** with substances typically found in the workplace. In the event an employee's uniform or coveralls are contaminated with a hazardous substance (as outlined in this CEHSP) the employee will turn the clothing over to supervision for proper cleaning or disposal as required. All clothes must be laundered in accordance with manufacturer's instructions. See section 4.2.2 for laundering of reusable clothing. [4] R/P

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4.2 CON EDISON PPE REQUIREMENTS

4.2.1 Selection of Protective Clothing

Decisions regarding the appropriate garment to wear including hard hats in and around structures must be made on a daily basis according to existing field conditions. The following conditions or materials may be encountered during daily duties:

- Potential for flame or electric arc.
- Presence of oil - non-PCB and PCB-containing.
- Presence of asbestos-containing material (ACM).
- Work with or on lead-containing material.
- Work with hazardous chemicals.

Attachment 1 is a flowchart that provides guidelines for the selection of protective clothing for these hazards. Attachment 2 identifies types of protective clothing.

Based on the potential exposure of the employees, natural fiber clothing may be acceptable. However, in any situation where employees may be exposed to the hazards of electric arc or flame these employees must wear appropriate flame-retardant clothing. These situations will be documented on the appropriate hazard assessment form for the task being conducted.

Requirements for Flame-Retardant Clothing

Employees and contractors must wear flame retardant (FR) clothing when performing tasks that may expose them to the hazards of flame or electric arc. Employees who are potentially exposed to flame or electric arc must wear Nomex, Indura, Ultrasoft, Ultrasoft AC or other FR materials approved by EH&S. A single layer of FR clothing is required as a minimum for all workers who perform work on energized electrical systems 50V and greater, but if the estimated arc flash energy exceeds 8 cal/cm^2 a second layer of FR clothing is required. Two layers will typically consist of FR coveralls worn over the FR shirt and FR pants.

In situations where employees and contractors are required to wear FR clothing, all layers of clothing underneath the FR clothing must be either FR or 100% natural fiber (wool or cotton), including undergarments. The outermost layer of clothing must be FR. Employees and contractors are prohibited from wearing clothing containing polyester, nylon, rayon, and acetate, alone or in blends, when performing tasks that may expose them to flames or electric arc.

In situations that present the potential for flame or electric arc exposure and the possibility that the garments may become soiled with oil, PCB-containing oil, or other liquid, limited-use FR/ **Chemical Resistant (CR)** disposable outerwear must be worn over the FR clothing. **These disposable FR/CR garments must not be worn without FR clothing.**

Clothing Requirements for Oil and PCB-Containing Oil

If oil is present and there is no reasonable likelihood for a flame or electrical arc to occur, employees must use garments that protect against the oil hazard. Depending on the amount of oil present and the potential for contact with oil, either disposable polycoated or Saranex coveralls must be worn. The selection of garment is independent of the PCB content of oil.

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- Saranex coveralls provide greater protection against oil breakthrough and ***penetration*** than do polycoated coveralls. For this reason Saranex coveralls must be worn when the amount of oil present may result in substantial contact.

- In situations where potential contact with oil is minimal, polycoated coveralls can be used.

If a situation has the potential for flame or electric arc exposure and possible soiling of garments with oil, limited-use FR disposable outerwear must be worn over FR clothing. **These disposable FR garments must not be worn without the FR clothing**.

After work involving potential contact with oil is completed, the disposable coveralls must be removed. If the garments have been in direct contact with oil containing 50 parts per million (ppm) or greater PCBs, the coveralls must be disposed of in accordance with CEHSP E06.12, *Disposal*. If the garments have been in direct contact with oil containing less than 50 ppm PCBs, the coveralls must be disposed of as general waste.

Clothing Requirements for Asbestos-Containing Materials

If asbestos-containing material (ACM) is present and there is reason to expect that a flame or electrical arc will not occur, employees must use garments that protect against the asbestos hazard. In this situation, a Con Edison-approved disposable coverall (Tyvek) must be worn during asbestos removal. This coverall may be worn alone or over FR coveralls.

If there is reason to expect that a flame or electrical arc may occur during asbestos work and there is a potential chemical or oil exposure, such as during the removal of arc-proofing tape in a manhole, the limited-use, chemically resistant FR disposable garments (polycoated Sontara) must be worn in place of the asbestos coverall. If there is reason to expect that a flame or electrical arc may occur during asbestos work and there is no potential chemical or oil exposure, the limited-use FR disposable garments (uncoated Sontara) must be worn in place of the asbestos coverall. In these situations, the limited-use FR disposable outerwear must be worn over the FR coveralls. **These disposable FR garments must not be worn without the FR coveralls**.

Upon completion of asbestos work, the asbestos coverall or limited-use FR garment must be removed and disposed of in accordance with the Asbestos Management Manual, Chapter 11 - Storage, Transfer, Transportation and Disposal.

Clothing Requirements for Work with Hazardous Liquid Chemicals

The proper selection of protective clothing depends on the nature of potential hazard (routes of entry, physical characteristics, toxicological properties, etc.), the type of work to be done, ergonomic constraints, and the chemical and physical performance or resistance characteristics required by the protective clothing. Both polycoated and Saranex Tyvek coveralls are chemical resistant to a wide range of chemicals. If a hazardous chemical splashes onto the coveralls, remove the chemical first by washing it off and then remove the coveralls. Saranex coveralls must be worn when the amount of acid, bases, solvents or other hazardous liquids present may result in substantial contact.

- In situations where potential contact with acids, bases, solvents and other hazardous liquid material is minimal, polycoated Tyvek must be worn.

- The PPE for battery maintenance activities includes a rubber apron and vinyl sleeves.

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Clothing Requirements for Welding and Burning

Employees exposed to the hazards created by welding, cutting or brazing operations, including assistants and fireguards, must wear flame-retardant coveralls. Employees performing welding or cutting activities must also don the following equipment:

- Flame-resistant gauntlet gloves.
- Flame-retardant coveralls.
- Flame-resistant aprons or leather vests, jackets, leggings, sleeves and spats worn over the flame-retardant coveralls when additional protection against sparks and radiant energy is needed.
- 100% natural fiber undergarments
- A flame-retardant skullcap with ear covers for overhead work.

Clothing Requirements for Lead Splicing Work

Persons performing lead splicing work must wear FR coveralls. If the job will result in soiling of the FR coveralls, limited-use FR garments must be worn over the FR coveralls. This should protect and extend the life of the FR coveralls. **The limited-use FR garment must not be used without the FR coveralls.**

Clothing Requirements for Working with Hazardous Materials

Clothing for all tasks where there is a potential for exposure to hazardous materials must be approved by EH&S. [5] R/P

Clothing Requirements for Working Near or Over Water

U.S. Coast Guard approved personal flotation devices must be worn by an employee whenever the danger of drowning exists. This condition may exist whenever an employee is working near or over water and could be pulled or pushed or fall into the water.

Each personal flotation device must be maintained in a safe condition and inspected frequently enough to ensure that it does not have rot, mildew, water saturation, or any other condition that could render the device unsuitable for use. An employee may cross streams or other bodies of water only if a safe means of passage, such as a bridge, is provided. [6] R/P

4.2.2 Reusable Clothing Maintenance and Laundering

Most reusable work garments require periodic laundering to clean them of general debris and material that accumulates on them at the work location due to incidental contact. The vendor will maintain those clothes that are part of the rental contract. All other clothes must be laundered according to manufacturer's specifications.

When ***accidental contact*** occurs and reusable clothing becomes soiled or contaminated with materials such as ACM or PCBs, appropriate precautions must be taken.

PCB-Contaminated Reusable Clothing

Reusable clothing that has been in direct contact with oil containing 50 ppm or greater PCBs must be disposed of in accordance with CEHSP E06.12, *Disposal*.

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Reusable clothing that has been in direct contact with oil containing 1 ppm or more PCBs, but less than or equal to 49 ppm PCBs, must be collected and bagged at the work location for vendor pickup.

Friable ACM-Contaminated Reusable Clothing

Reusable clothing that has been in direct contact with friable ACM must be wet down to minimize fiber release, placed in a sealed container, and collected from the employee. The contaminated garment must be removed and disposed of in accordance with the Asbestos Management Manual, Chapter 11 - Storage, Transfer, Transportation and Disposal.

Laundering of 100% Cotton Clothing

The laundering instructions for 100% cotton garments are as follows:

- Machine wash in warm water with similar colors.
- Use only non-chlorine bleach, when needed.
- Tumble dry at low to medium temperature.
- Iron on a low to medium temperature, if required.

Laundering Cotton FR Clothing

Cotton FR (e.g. Ultrasoft, Ultrasoft AC) has been treated to make them fire retardant. When washed properly, the fire-retardant treatment should last the life of the garment. The manufacturer's instructions for laundering treated fabrics must be adhered to, including the following washing instructions:

- Wash clothing inside out to minimize edge and surface abrasion.
- Use a water level sufficient for the quantity of clothing to be washed, preferably the high tide level on the washer.
- Use a quality detergent, such as Tide, All, Era, Yes, or Wisk. Follow the detergent manufacturer's instructions.
- Use a temperature that is as low as possible but that still cleans the garment. When using a quality detergent, the warm or cold setting may be sufficient.
- Do not use chlorine (sodium hypochlorite) bleach such as Clorox as this can affect the fire-retardant properties of these garments.
- When drying garments, use the minimum setting required to dry the clothing in a practical time
- Dry garments inside out.
- To minimize shrinkage, immediately remove garments from the clothes dryer when they are dry or slightly damp.

Laundering Nomex Garments

Nomex garments are made of flame-retardant aramid fibers. The flame-retardant property is "built into" the fiber; it is not applied to a fabric as a treatment or additive, as in the case of the Indura and Proban coveralls. The manufacturer's instructions for laundering Nomex garments must be adhered to, including the following washing instructions:

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- Nomex garments must be sorted and washed separately from other garments to prevent flammable fibers/lint from being transferred to the Nomex garment.
- Heavily soiled or stained garments must be pre-treated as soon as possible with a full-strength heavy-duty liquid detergent.
- The wash load size must allow the garment to move freely throughout the wash and rinse cycles.
- Normal wash water setting (approximately 140^{o} Fahrenheit) is adequate for moderately soiled garments. Higher temperatures may be required for heavily soiled or stained garments.
- A synthetic heavy-duty liquid laundry detergent, such as liquid Tide, All, Era, Yes, and Wisk, is recommended for cleaning Nomex garments.
- Chlorine bleach must not be used. Bleach will not degrade the flame-retardant properties of the garment, but it may cause strength and color loss over time.
- Nomex garments must be tumble-dried on medium or high temperature settings.
- Iron on medium setting, if necessary. [7] R/P

4.3 PPE INSPECTION AND MAINTENANCE

This information will help to ensure that equipment is maintained in a satisfactory condition and provides the required protection when used. The following minimum requirements for inspection and maintenance will be followed.

- PPE must be properly inspected prior to use. Damaged or missing items like holes in gloves or protective clothing, missing side shields on glasses, and broken laces or cracked soles on shoes can significantly impact the effectiveness of the PPE. Signs of wear, such as smooth soles on shoes that can cause slipping or scratches on goggles that limit vision, can present new hazards. PPE that is damaged, missing items, or shows signs of wear, jeopardizing the protection afforded by the equipment, will be removed from service and repaired or replaced.
- PPE must be cleaned and properly decontaminated in accordance with manufacturer recommendations.
- PPE must be properly stored to protect it from exposure to conditions that can damage or compromise its effectiveness. Specific locations acceptable for the storage of PPE will be identified.
- Employees must be familiar with methods for obtaining new PPE in the event that testing and inspection identify unacceptable equipment.

Con Edison maintains a supply of PPE that can be used by facility personnel when needed. The equipment is specific to the tasks performed by Con Edison personnel. [9] R/P

4.4 TRAINING AND TESTING

Refer to CEHSP S05.01, *Hazard Assessment and Personal Protective Equipment*, Section 4.4 for detailed training and testing requirements. [10] R/P

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4.5 RECORDKEEPING

In accordance with CEHSP S05.01, *Hazard Assessment and Personal Protective Equipment,* the Training Coordinator for each operating organization must retain training records for three years. Additionally, OSHA 1910.269(a)(2)(vii) requires that training records associated with FR clothing be maintained for the duration of the employee's employment. The Safety Administrator must maintain hazard assessment documentation for all job types currently performed within the organization. [11] R/P

5.0 DEFINITIONS

***Accidental Contact*:** An unexpected event where a substantial amount of a substance spills, splashes, sprays, or otherwise comes into contact with a worker. It is not a typical occurrence for the duties/job being performed.

Body: Arms, legs, and torso.

Hazard Assessment: A systematic review performed to identify exposure hazards and appropriate PPE for specific work operations. This assessment includes a review of the work activities, equipment, and materials used, and end products and by-products to evaluate the potential for physical contact, noise hazards and/or respiratory hazards.

Hazard Assessment Certifications: Written verification that identifies a completed exposure assessment, including the evaluated tasks/processes and areas, the person who performed the assessment, and the date(s) of the assessment.

Incidental Contact: Materials that an employee may contact during the performance of his daily duties. For example, an auto mechanic contact with lube oil while replacing a part or a troubleshooter brushing up against equipment in a vault during an inspection that results in a smudge on their clothing.

Penetration: Flow of chemicals through clothing discontinuities, such as zippers, seams, and pinholes.

***Personal Protective Equipment (PPE)*:** Clothing and equipment worn by personnel to prevent contact with hazards present in the work area. PPE includes safety glasses, face shields, gloves, safety shoes, hearing protection, hard hats, etc.

Proper: Approved, certified, or suitable, within acceptable guidelines set forth by governing codes and standards, as well as recognized safe work practices.

6.0 RESPONSIBILITIES

Employees: The PPE user is responsible for following the requirements of the PPE procedure, including: wearing required PPE; attending required training; caring for, cleaning, and maintaining PPE; and submitting equipment for repair or replacement.

Environment, Health, and Safety (EH&S): EH&S performs the following functions:

- Reviews applicable regulations and ensures that procedures meet all regulatory requirements.

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- Revises procedures as applicable.
- Reviews/approves controlled documents prior to release.
- Distributes updates and changes.
- Reviews training prepared by the Learning Center.
- Provides technical assistance to Safety Administrators.

Facility or Site Manager Responsible for Compliance: The Con Edison designated individual within each operating organization who is responsible for ensuring compliance with federal, state, and local regulations and this procedure.

Law Department: The Law Department assists and provides guidance to EH&S by reviewing changes to these procedures in light of all applicable statutes and regulations to ensure that the procedures meet all legal requirements.

Operating Organizations: Unless otherwise indicated, operating organizations are responsible for compliance with federal, state, and local regulations and this procedure.

Safety Administrator: Responsible for performing hazard assessments, selecting PPE, and maintaining hazard assessment certifications.

Supervisors: Responsible for ensuring that personnel wear proper PPE and for performing necessary training.

Training Coordinators: Enters PPE training records into the Training Registration System.

7.0 REFERENCES

4.1 HAZARD ASSESSMENT AND GENERAL GUIDELINES FOR SELECTION AND USE OF PPE

[1] 29 CFR 1910.132(d) (hazard assessment, including written certification requirement); 29 CFR 1910.132, Appendix B (non-mandatory compliance guidelines for hazard assessment, including Section 7, reassessment of hazards). NOTE: The OSHA regulations do not specifically require reassessment of hazards, although the issue is addressed in the Appendix B non-mandatory guidelines).

[2] 29 CFR 1910.137 (electrical protective equipment); 29 CFR 1910.269(l)(6) (apparel for electrical power generation, transmission, and distribution).

[3] USDOT Federal Highway Administration, *Manual on Uniform Traffic Control Devices,* Section 6D.03, Worker Safety Considerations (2003 Edition) (clothing requirements when working near traffic). The manual can be found at: http://mutcd.fhwa.dot.gov/HTM/2003/html-index.htm. The remaining requirements in this section relating to fit and appearance are required by Con Edison as a matter of policy.

[4] See Note 6 below regarding laundering.

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4.2 CON EDISON REQUIREMENTS

[5] 29 CFR 1910.132 (general PPE requirements); 29 CFR 1910.137 (electrical protective equipment); 29 CFR 1910.252(b)(3) (protective clothing for welding, cutting and brazing); 1910.269(l)(8)(v) (PPE requirements for potential arc flash during electrical distribution, transmission or generation). The specific clothing identified in this section has been determined to meet OSHA requirements relating to proper PPE which require sufficient protection to limit burns to first degree or less.

[6] 29 CFR 1910.269(w)(5)(i)-(iii) (requiring personal flotation device when danger of drowning exists). NOTE The cited provision applies only to the operation and maintenance of electric power generation, control, transformation, transmission and distribution lines and equipment. Con Edison applies this requirement to all activities that involve the potential for drowning as a matter of policy.

[7] 29 CFR 1910.132(a) (general PPE maintenance requirement); 29 CFR 1910.132(e) (prohibiting use of damaged/defective PPE); 29 CFR 1910.132, Appendix B, Sec. 12 (non-mandatory: cleaning and maintenance); 29 CFR 1910.137(b) (in service use and care of electrical protective equipment). NOTE: Con Edison has developed the specific procedures in this section relating to maintenance and laundering of particular types of clothing to ensure that the clothing continues to provide proper protection to Con Edison employees.

[8] 29 CFR 1910.269 and Subpart V. (operation and maintenance of electric power generation, control, transformation, transmission and distribution lines and equipment) NOTE: Con Edison achieved compliance for arc flash protection through use PPE, increased distance from arc sources, remote operation, faster trip times, and/or procedure changes.

4.3 PPE INSPECTION AND MAINTENANCE

[9] 29 CFR 1910.132(a) (general PPE maintenance requirement); 29 CFR 1910.132(e) (prohibiting use of damaged/defective PPE); 29 CFR 1910.132, Appendix B, Sec. 12 (non-mandatory: cleaning and maintenance); 29 CFR 1910.137(b) (in service use and care of electrical protective equipment). NOTE: Con Edison has developed the specific procedures in this section relating to inspection and maintenance to ensure that protective clothing is maintained in a satisfactory condition.

4.4 TRAINING AND TESTING

[10] See CEHSP S05.01, *Hazard Assessment and Personal Protective Equipment*, for training and testing requirements.

4.5 RECORDKEEPING

[11] 29 CFR 1910.132(d)(2) (written hazard assessment certification); 29 CFR 1910.132(f)(4) (training records); 29 CFR 1910.269(a)(2) (electric power generation, transmission and distribution training recordkeeping). NOTE: the OSHA regulations do not specify a retention period for training records under 29 CFR 1910.132(f)(4). Con Edison has adopted a three-year record retention period as a matter of policy. 29 CFR

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1910.269(a)(2) requires training records to be retained for the duration of the employee's employment**.** This training covers PPE, including FR clothing.

National Safety Council - Accident Prevention Manual for Business and Industry, 10th edition.

8.0 REVISION HISTORY

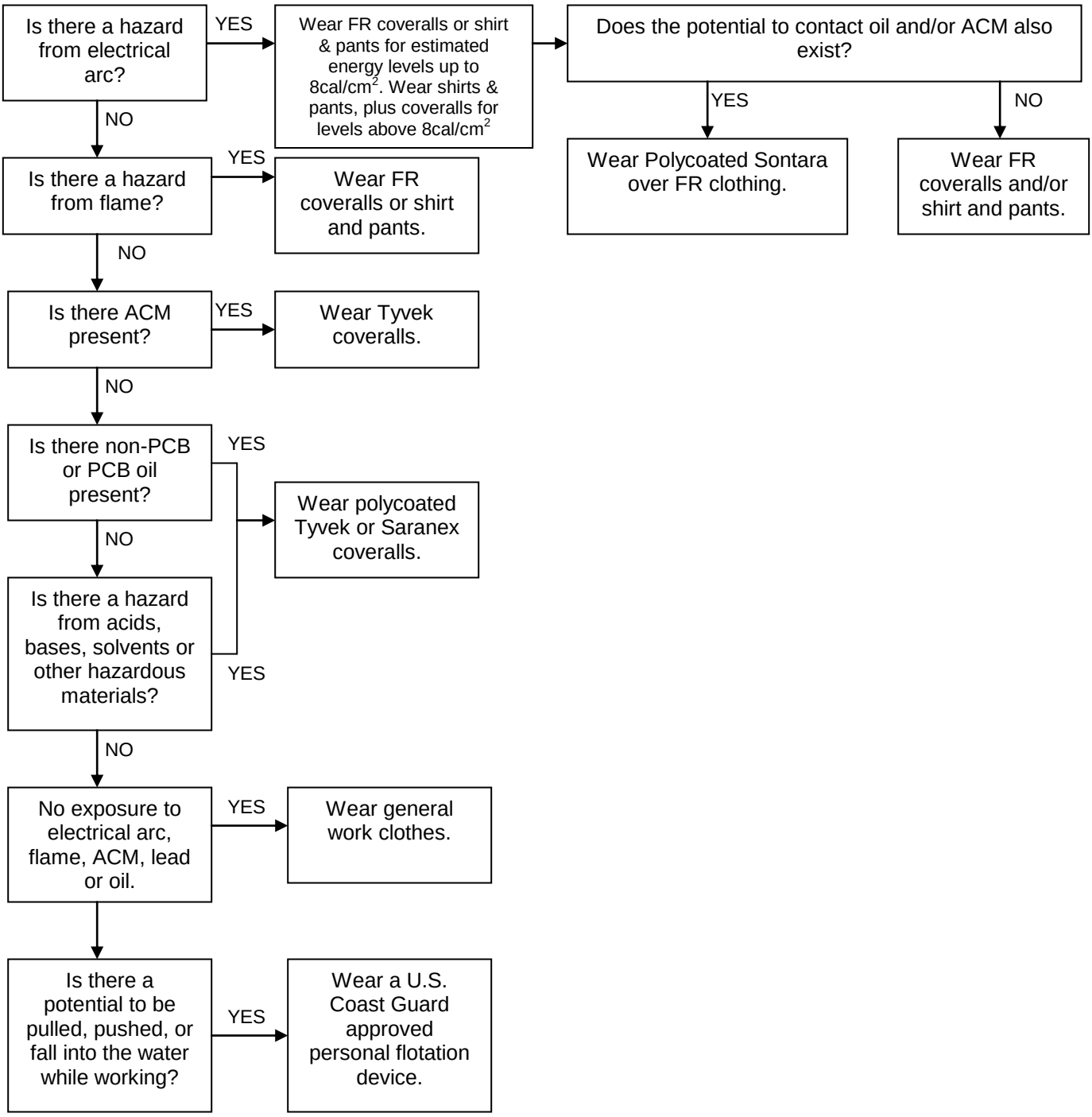
Revision Date	Revision #	Summary of Change	Author
6/28/2013	9	Periodic review by SME and addition of Induara, Ultrasoft, Ultrasoft AC or any other FR clothing approved by Corporate EH&S for Gas Operations. Added revision history section. Assign new revision #, revision and effective date to reflect review of this CEHSP.	P. Kothari, S. Ng
8/27/2013	10	Updated section 4.2.1 to include statement pertaining to the use of hard hats in and around structures; Updated various hyperlinks and title of other CEHSPs referenced throughout this document; Updated revision date and number to reflect these changes	B. Suggs S. Ng
6/16/2015	11	Included new Arc Flash PPE requirements as required by OSHA 269 standard.	W. Capune

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ATTACHMENT 1

GUIDELINES FOR SELECTION OF PROTECTIVE CLOTHING



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ATTACHMENT 2
PERSONAL PROTECTIVE CLOTHING

PROTECTIVE CLOTHING	USE	GROUP/OPERATION
Flame Retardant (FR)	• Worn when there is potential exposure to flame or electric arc. • Worn when performing lead splicing.	Steam, Powerhouse, Electrical Welding, Hotwork Gas Operations Welding, Hotwork
U.S. Coast Guard Approved Personal Flotation Device	Worn when the potential of drowning exists.	Steam, Powerhouse, Electrical, Spill Response Team Members
Tyvek	Worn when potential for contact with asbestos-containing materials (ACM).	Maintenance, Spill Response Team Members
Kleenguard Ultra (Tyvek equivalent)	Worn for general utility, asbestos, bloodborne pathogens, lead dust, bulk chemical delivery, and short-term, incidental contact with oil, including polychlorinated biphenyls (PCB).	Maintenance, Spill Response Team Members
Disposable Polycoated / Saranex	• Polycoated is worn when there is minimal potential for contact with PCBs. Saranex is worn where there is greater potential for contact with PCBs.	Maintenance, Spill Response Team Members
Disposable Polycoated/ Saranex	• Polycoated is worn when there is a minimal potential for contact with acid, bases, solvents and other hazardous liquid materials. • Saranex is worn where there is a greater potential for contact with acids, bases, solvents and other hazardous liquid materials	Acid Deliveries, Maintenance of Acid Systems, solvents
Polycoated Sontara	• Polycoated Sontara is worn when there is both a potential for arc or flame and a potential for exposure to an oil contaminant or asbestos. This garment protects normal FR clothing.	Operations where there is an exposure to arc or flame and where there is an exposure to oil and/or asbestos
Uncoated Sontara	Uncoated Sontara is worn when there is a potential for arc or flame and no potential for exposure to an oil contaminant. This garment protects normal FR clothing.	Operations where there is an exposure to arc or flame and where there is an exposure to asbestos (no oil)
Rubber Apron Vinyl Sleeves	Rubber apron bib style and vinyl sleeves are worn over work clothes to protect against acids.	Battery Maintenance and acid handling

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CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
CORPORATE ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURE

CEHSP S12.00 – Lockout/Tagout Procedures
Revision 4: 11/17/2014 Effective Date: 01/01/2015

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1.0 PURPOSE

IT IS THE POLICY OF CON EDISON TO COMPLY WITH ALL FEDERAL REGULATIONS RELATING TO *LOCKOUT/TAGOUT*. The purpose of this procedure is to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, startup or release of stored energy could occur and cause injury, the machine or equipment is isolated from the ***energy source*** and rendered inoperative.

This document does not supersede Con Edison's General Instructions Governing Work on System Electrical Equipment (i.e., Bluebook) or any other existing corporate documents (i.e., COP 5-1-2, Processing & Controlling Operating Orders and Work Permits).

2.0 APPLICABILITY

This Corporate, Environmental and Safety Procedure (CEHSP) applies to all Con Edison facilities, each of which is responsible for establishing and documenting site-specific lockout/tagout procedures for each piece of equipment, machinery or system under that site's supervision. Procedures may be established for classes of equipment or machinery if their function and operation are similar and the procedure can collectively account for the control of all hazardous energy sources.

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This CEHSP also applies to all outside contractors performing work on Con Edison equipment within the facility. It is the responsibility of the Facility's Manager to ensure compliance. Failure to comply may result in immediate termination of such outside contractor's services.

Procedures must be developed, documented and utilized by each Con Edison site for the control of potentially hazardous energy when employees are engaged in the activities covered by this section.

Exception: The site does not need to document the required procedure for a particular machine or equipment, when **all** of the following elements exist:

(1) The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shut down which could endanger employees;

(2) The machine or equipment has a single energy source which can be readily identified and isolated;

(3) The isolation and locking out of that energy source will completely de-***energize*** and deactivate the machine or equipment;

(4) The machine or equipment is isolated from that energy source and locked out during ***servicing and/or maintenance***;

(5) A single ***lockout device*** will achieve a locked-out condition;

(6) The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance;

(7) The servicing and/or maintenance does not create hazards for other employees; and

(8) The employer, in utilizing this exception, has had no accidents involving the unexpected activation or re-energization of the machine or equipment during servicing and/or maintenance.

3.0 INTRODUCTION

3.1 PROCEDURE

This procedure applies to any job task that may expose workers to potentially hazardous energy. There are several qualified exceptions:

- Anytime a guard is removed. Minor tool changes and adjustments and/or other minor servicing activities that are routine, repetitive, and integral to the use of the equipment and that occur during ***normal production operations***, are not covered by the lockout/tagout standard, provided the work is performed using alternative measures that provide effective protection.

- While servicing or maintaining cord and plug connected electrical equipment, provided that the equipment is unplugged from the energy source; and the plug remains under the exclusive control of the employee performing the servicing and/or maintenance.

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- Exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations when employees are properly trained and protected from the hazards.

- ***Hot tap*** operations that involve transmission and distribution systems for gas, steam, water, or petroleum products when they are performed on pressurized pipelines provided that continuity of service is essential, shutdown of the system is impractical, and employees are provided with alternative protection that is equally effective. [1] R

3.2 PERSONNEL

Authorized Employees

An authorized employee is one who is able to initiate these procedures, and to employ all parts of the procedures to ensure the safe completion of work. Authorized employees are selected on the basis of their formal training, on the job experience, licenses held and familiarity with mechanical and electrical work and associated hazards related to this work. All authorized employees must meet the training requirements stated in section 4.7 of this procedure.

Affected Employees

Individuals whose jobs requires them to operate a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires them to work in an area in which such servicing or maintenance is being performed.

All other company and outside contract employees whose work operations are or may be in an area where lockout/tagout procedures may be utilized are also deemed affected employees. [2] R

4.0 COMPLIANCE REQUIREMENTS

4.1 LOCKOUT PROCEDURE

Except under conditions noted in Section 4.4, the only authorized employee that can remove a lock and tag is the authorized employee who installed the lock and tag.

- The authorized employee who performed all the steps in Section 4.2, A-B-C-D-E, may apply a sequentially numbered padlock to equipment capable of accommodating a padlock for the purpose of preventing the normal operation of an ***energy isolating device*** such as a switch, valve, etc.

- The authorized employee will continue the procedure in Section 4.2 steps F and G to completion, and return the padlock along with all Stop Tags.

- The authorized employee will update log entries as stated in 4.2 E. [3] R/P

4.2 LOCKOUT/TAGOUT PROCEDURE SEQUENCE

A. Notification

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The authorized employee will notify the supervisor of the facility and any affected employee in the facility that a lockout/tagout procedure will be put into effect, the location of the equipment to be taken off-line, and the reason for the procedure.

The authorized employee will issue the appropriate amount of Stop Tags, and enter data into a logbook consisting of:

- Date and time
- ID number of tag(s) issued
- Equipment removed from service
- Authorized employee name(s)
- Date and time tags were returned (equipment returned to service).

The authorized employee is to acknowledge understanding the procedure, and the importance of adhering to the procedure.

B. Identification and Location of Devices

After receiving a job briefing on the hazards associated with the work assignment and required personal protective equipment, the authorized employee will make a survey to locate and identify all energy isolating devices (i.e., which switch(s) valve(s) or other isolating devices apply to the equipment) to be locked out.

Note: More than one energy source may be involved.

C. Shut Down of Equipment

The authorized employee must shut the machinery or equipment down in the operational method described by departmental procedure, or stop and obtain an operating procedure from his/her supervisor before shutting down the equipment.

D. Isolation - Dissipation

The authorized employee will operate the switch, valve, or other energy-isolating device, or multiple combinations thereof, so that the equipment is isolated from all of its energy sources. Stored energy between the isolating device and the equipment must be dissipated. Energy such as spring-loaded components, rotating components, pressurized hydraulic, water, steam, gas, air pressure, or potential stored energy (i.e., capacitors) must be relieved of potential hazard by blocking, restraining, re-positioning or bleeding down as required.

E. Lockout/Tagout Procedure Sequence

Lockout is the preferred method of isolating machines or equipment from energy sources, and must be used when the energy isolating device is ***capable of being locked out***.

A tagout procedure may be used on those energy isolating devices that are incapable of being locked out after all available methods and means have been exhausted and no satisfactory alternative is available.

The authorized employee will apply Stop Tags to each energy isolating device, in accordance with an associated procedure.

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The authorized employee will record the following information on each tag affixed:
1. Name of employee invoking the procedure
2. Date procedure initiated
3. Reason for procedure
4. Warning legend

When the equipment is returned to operation, the authorized employee will remove all Stop Tags and log each stop tag removed, completing the procedure.

F. Verification

The authorized employee will verify that all energy has been isolated by going back to the original device and verifying by testing that an unexpected release of stored energy will not occur (i.e., electrical, hydraulic, pneumatic, pressurized liquids and gases etc.). After ensuring that personnel are not exposed to any hazards from the release of stored energy, the authorized employee will follow written procedures for performing the assigned task.

G. Restoring Machine or Equipment to Normal Operation

After the assigned task is completed and the equipment is ready for return to normal operation, the authorized employee will perform the following sequence:

1. Check area around the equipment to be sure no other personnel are exposed to danger. Notify all affected employees of the intent to restore energy.
2. Remove all tools and supplies from immediate vicinity.
3. Check to make certain all protective guards, covers, casings, etc. are in place, and that all moving parts are unrestricted.
4. Check position of local starting mechanism, valves, controls, etc. to ensure against premature or unwanted action leading to a hazardous condition.
5. Remove, in reverse sequence of application, all Stop Tags.
6. Re-position valves, switches, etc. in compliance with operating procedures.
7. Operate the energy isolating devices to restore energy to the equipment.
8. Notify the supervisor of the facility and affected employees of the restoration of energy to the equipment.
9. Operate the equipment in the normal manner to detect any discrepancies. Repeat procedures as found necessary.
10. Return Stop Tags and update the log in accordance with step 4.1 E. [4] R/P

4.3 GROUP LOCKOUT OR TAGOUT

When work is performed on machinery or equipment involving more than one person, each employee in the group is responsible for adhering to all provisions of the procedures for lockout or tagout.

In the event a group of employees require the procedure to be used, the following actions must be followed:

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1. A single authorized employee will be designated by the supervisor of the facility as having primary responsibility for a set number of persons working under the protection of a group procedure.

2. This authorized employee will be the individual designated to coordinate with the affected employees and ensure continuity of protection.

3. Each employee working on the unit must review with the authorized employee designated by the supervisor of the facility, placement of Stop Tag or padlock device on each energy isolating device de-energized under the procedure.

4. All affected employees must receive a job briefing by an authorized employee. [5] R

4.4 SHIFT OR PERSONNEL CHANGES

Shift Changes

When work on a machine or piece of equipment will continue into the next work shift, protection must be continued. The oncoming authorized employee must be satisfied that the procedure is properly in effect and it is safe to transfer lockout or ***tagout devices***.

- The oncoming authorized employee will be given a job briefing, and will accompany the off-going authorized employee to the location of each Stop Tag or padlock device.

- The off-going authorized employee will point out the location of all Stop Tags and padlocks applied during his/her shift.

- The oncoming authorized employee will record the number of Stop Tags and padlocks applied.

- The oncoming authorized employees must ensure that they are familiar with the existence and reason for the lockout or tagout procedure, and the number of Stop Tags and padlock devices recorded.

- The authorized employees will review the number of Stop Tags and padlock devices for discrepancies, and then record the transfer of responsibility from the off-going to the oncoming employee in the log.

Personnel Changes

Each Stop Tag or padlock device must be removed from each energy isolating device by the authorized employee who applied them.

If the employee who initiated the procedure is not available to remove the Stop Tag or padlock device, they may be removed by a ***qualified employee*** provided the following conditions are completely satisfied:

1. The qualified employee must be trained in all aspects of this procedure.

2. The qualified employee has complied with all parts of this procedure prior to removing the device.

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3. The qualified employee verifies that the employee who initiated the procedure is unavailable. All reasonable attempts must be made to contact the employee and inform the employee of the intended action.

The employee will be informed that the above action was taken before the employee begins work again at the location.

Special Circumstances

In situations where a lockout device must be removed by someone other than the person who installed it, the following steps must be taken:

- A qualified employee on site must personally verify that no affected employees are exposed to danger from re-energizing or reactivating equipment.

- The lockout device(s) may be removed by cutting or similar method only after the qualified employee has verified that no affected employee exposure exists. [6] R

4.5 ANNUAL INSPECTION

The operating organization must conduct, on at least an annual basis, an inspection of the requirements and compliance with this procedure. This inspection must:

- Be performed by an authorized employee other than those using the procedure.

- Correct any inadequacies or deficiencies found.

- Include a review of the employee's responsibilities between each authorized employee and the inspector.

- Be certified to include the machine or equipment, the date of the inspection, the employees included, and the person performing the inspection.

Attachment 2 must be used for these inspections.

These annual inspections are intended to assure that the energy control procedure continues to be implemented properly and that the employees involved are familiar with their responsibilities under that procedure. The inspection must be able to determine whether the:

- Steps in the energy control procedure are being followed;

- Employees involved know their responsibilities under the procedure;

- Procedure is adequate to provide the necessary protection, and what changes, if any, are needed.

When lockout is used, the inspection must include:

- A review with all authorized employees for the procedure being inspected,

- Their responsibilities under that procedure.

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- Group meetings between the authorized employee and affected employees.

When tagout is used, this review must be performed with all affected employees, as defined in the standard, as well as with all authorized employees, for the procedure being inspected.

The site's senior manager must certify that the annual inspections have been performed. The certification must identify:

- The machine or equipment on which the energy control procedure was being utilized,
- The date of the inspection,
- The employees included in the inspection,
- And the person performing the inspection.

The results of the audit will be forwarded to the manager of maintenance, for recordkeeping. [7] R

4.6 PROTECTIVE HARDWARE AND MATERIAL

Lockout and tagout equipment must be provided in sufficient quantity to satisfy the requirements of this procedure. Such hardware and material must be capable of safely tagging, isolating, securing or blocking machines and equipment from energy sources.

Lockout and tagout devices must be singularly identified, must be the only devices used for controlling energy, and must not be used for other purposes.

Whenever replacement or major repair, renovation or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machine or equipment must be designed to accept a lockout device

Durable

Lockout and tagout devices must be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

Tagout devices must be constructed and printed so that exposure to weather condition or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

Tags must not deteriorate when used in corrosive environments such as areas where acid and alkaline chemicals are handled and stored.

Standardized

Lockout and tagout devices must be standardized within the facility where used in at least one of the following criteria - color, shape, or size. Additionally, on tagout devices, print and format must be standardized.

Substantial

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Lockout devices must be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.

Tagout devices, including their means of attachment, must be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means must be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than fifty (50) pounds and having the basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

Identifiable

Lockout and tagout devices must indicate the identity of the employee applying the devices.

Tagout devices must warn against hazardous condition if the energy isolating device is not operated, and must include a legend such as the following - Do Not Open, Do Not Close, Do Not Start, Do Not Energize, Do Not Operate. [8] R

4.7 TRAINING

The company will provide training to ensure that employees understand the purpose and function of the lockout/tagout procedure and that the knowledge and skills required for the safe application, usage and removal of lockout/tagout controls are acquired by authorized employees.

The company must certify that employee training has been accomplished and is up to date. The certification must contain each employee's name and dates of training.

Equipment-Specific Training

Each authorized employee must receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.

Each affected employee must be instructed in the purpose and use of the lockout/tagout procedure.

All other employees whose work operations are or may be in an area where lockout/tagout procedures may be utilized must be instructed about the procedure and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.

Specific instructions will include the proper procedure for locking out and tagging out of devices. Specific training will be given regarding the limitations of tags. Attachment 1 must be utilized for this purpose.

Training will be done through The Learning Center, or by the safety administrator or by the responsible shop operating supervisor. The tracking and recording of this training will be the responsibility of the department training Coordinator. [9] R/P

Retraining

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Retraining must be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedure.

Additional retraining must be conducted whenever a periodic inspection reveals, or local EH&S has reason to believe, that there are deviations from, or inadequacies in the employee's knowledge, or use of the energy control procedures.

The training must reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary. [10] R

5.0 DEFINITIONS

Affected Employee: An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized Employee: A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

Capable of Being Locked Out: An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

Energized: Connected to an energy source or containing residual or stored energy.

Energy Isolating Device*:* A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

Energy Source: Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Hot Tap: A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Lockout: The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

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Lockout Device: A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

Normal Production Operations: The utilization of a machine or equipment to perform its intended production function.

Qualified Employee: A qualified person is a person who has been trained and has demonstrated proficiency, in compliance with 29 CFR 1910.147(c)(7), to perform servicing and maintenance on the machine or equipment to be inspected.

Servicing and/or Maintenance: Workplace activities such as constructing, installing, ***setting up***, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or un-jamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

Setting Up: Any work performed to prepare a machine or equipment to perform its normal production operation.

Tagout: The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout Device: A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

6.0 REFERENCES

3.0 INTRODUCTION

3.1 PROCEDURE

[1] 29 CFR 1910.147(a)(2)(ii)-(iii) (applicability and exceptions).

3.2 PERSONNEL

[2] 29 CFR 1910.147(b) (definitions).

4.0 COMPLIANCE REQUIREMENTS

4.1 LOCKOUT PROCEDURE

[3] 29 CFR 1910.147(c)(1) (energy control program generally). See 29 CFR 1910.147, Appendix A (non-mandatory guidelines: typical minimal lockout procedure).

4.2 LOCKOUT/TAGOUT PROCEDURE SEQUENCE

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[4] 29 CFR 1910.147(c)(2) (preference for lockout); 29 CFR 1910.147(c)(3) (full employee protection); 29 CFR 1910.147(c)(4) (energy control procedure); 29 CFR 1910.147(c)(9) (notification of employees); 29 CFR 1910.147(d)(1)-(6) (preparation for shutdown, machine or equipment shutdown; machine or equipment isolation; lockout or tagout device application; stored energy; verification of isolation); 29 CFR 1910.147(e)(1)-(3) release from lockout or tagout). See 29 CFR 1910.147, Appendix A (non-mandatory guidelines: typical minimal lockout procedure).

4.3 GROUP LOCKOUT OR TAGOUT

[5] 29 CFR 1910.147(f)(3) (group lockout/tagout).

4.4 SHIFT OR PERSONNEL CHANGES

[6] 29 CFR 1910.147(c)(8) (requiring lockout/tagout to be performed only by authorized employee performing servicing and/or maintenance); 29 CFR 1910.147(f)(4) (shift changes).

4.5 ANNUAL INSPECTION

[7] 29 CFR 1910.147(c)(6).

4.6 PROTECTIVE HARDWARE AND MATERIAL

[8] 29 CFR 1910.147(c)(5) (protective materials and hardware).

4.7 TRAINING

[9] 29 CFR 1910.147(c)(7)(i), (iv) (training and recordkeeping). NOTE: This section includes Con Edison-specific procedures relating to training and recordkeeping.

[10] 29 CFR 1910.147(c)(7)(iii) (retraining).

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REVISION HISTORY

Revision Date	Revision #	Summary of Change	Author
11/17/14	5	Periodic Review. Inserted exception for work conducted under Subpart S	M. McFarland

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ATTACHMENT 1
EXAMPLE SITE PROCEDURE

GENERAL

The following simple lockout procedure is provided to assist employers in developing their procedures so they meet the requirements of this standard. When the energy-isolating devices are not lockable, tagout may be used, provided the employer complies with the provisions of the standard that require additional training and more rigorous periodic inspections. When tagout is used and the energy-isolating devices are lockable, the employer must provide full employee protection (see 29 CFR 1910.147 (c)(3)) and additional training and more rigorous periodic inspections are required. For more complex systems, more comprehensive procedures may need to be developed, documented, and utilized.

Lockout Procedure for

_____

(Name of Company for single procedure or identification of equipment if multiple procedures are used).

Purpose

This procedure establishes the minimum requirements for the lockout of energy isolating devices whenever maintenance or servicing is done on machines or equipment. It must be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources and locked out before employees perform any servicing or maintenance where the unexpected energization or start-up of the machine or equipment or release of stored energy could cause injury.

Compliance With This Program

All employees are required to comply with the restrictions and limitations imposed upon them during the use of lockout. The authorized employees are required to perform the lockout in accordance with this procedure. All employees, upon observing a machine or piece of equipment which is locked out to perform servicing or maintenance, must not attempt to start, energize, or use that machine or equipment.

_____

Type of compliance enforcement to be taken for violation of the above.

Sequence of Lockout

(1) Notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.

_____

Name(s)/job title(s) of affected employees and how to notify.

(2) The authorized employee must refer to the company procedure **for the particular machine or equipment** to identify the type and magnitude of the energy that the machine or equipment

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utilizes, must understand the hazards of the energy, and must know the methods to control the energy.

Type(s) and magnitude(s) of energy, its hazards and the methods to control the energy.

(3) If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open switch, close valve, etc.).

Type(s) and location(s) of machine or equipment operating controls.

(4) De-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).

Type(s) and location(s) of energy isolating devices.

(5) Lock out the energy isolating device(s) with assigned individual lock(s).

(6) Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.

Type(s) of stored energy - methods to dissipate or restrain.

(7) Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.

Caution: Return operating control(s) to neutral or "off" position after verifying the isolation of the equipment.

Method of verifying the isolation of the equipment.

(8) The machine or equipment is now locked out.

Restoring Equipment to Service

When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps must be taken.

(1) Check the machine or equipment and the immediate area around the machine to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.

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(2) Check the work area to ensure that all employees have been safely positioned or removed from the area.

(3) Verify that the controls are in neutral.

(4) Remove the lockout devices and reenergize the machine or equipment. Note: The removal of some forms of blocking may require re-energization of the machine before safe removal.

(5) Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

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ATTACHMENT 2
LOCKOUT/TAGOUT PERIODIC INSPECTION

Facility Name _____ Date _____
Address _____
Equipment Name _____ I.D. No. _____
Authorized Inspector (Print) _____ I.D. No. _____

The identified equipment requires a periodic inspection of the energy control procedures according to §1910.147(6) The Control of Hazardous Energy (Lockout/Tagout). Check (✓) or complete all elements of this form that apply to the Periodic Inspection. Note deficiencies in comments section.

ENERGY SOURCES

☐ Electrical ☐ Hydraulic ☐ Chemical ☐ Other _____
☐ Mechanical ☐ Pneumatic ☐ Thermal _____

ENERGY ISOLATING DEVICES

☐ A manually operating electrical circuit breaker.
☐ A disconnect switch
☐ A manually operated switch by which the circuit's conductors can be disconnected from all underground supply conductors (no pole can be operated individually).
☐ A line valve
☐ A block
☐ A similar device used to block or isolate energy.
☐ Other _____

Note: Push buttons, selector switches, and other circuit type devices are not energy-isolating devices.

	YES	NO	COMMENTS
Do authorized employees understand the energy control procedures for this equipment?			
Do the authorized employees understand the requirements of the standard for this equipment?			
Do the authorized employees understand which locks/tags are to be used on this equipment?			
Are the lockout/tagout procedures being followed?			
Do employees understand their responsibilities in the energy control procedure?			
Have any deviations or inadequacies been identified during this inspection that require attention? If so, list.			
Have tagout procedures been reviewed when tagout alone is the only means of energy isolation?			
Have you reviewed the removal of an isolating circuit breaker?			
Have you reviewed blocking of a controlling switch?			
Have valve handle removal procedures been reviewed?			
Have you reviewed the opening of an extra disconnect switch?			

The items checked above have been reviewed with/explained to the authorized employees at the time of the periodic inspection.

Authorized Employee (Signature)	Date	Authorized Employee (Signature)	Date

I hereby certify that the periodic inspection for compliance with lockout/tagout standards on the equipment as specified by OSHA 29 CFR §1910.147 has been satisfactorily completed with the authorized employees identified above.

Inspector _____ _____ _____
Signature Title Date

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CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

CORPORATE ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURE

CEHSP S17.01 – Electrical Enclosed Spaces

Revision 19: 04/23/2014 Effective Date: 07/01/2014

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1.0 PURPOSE

IT IS THE POLICY OF CON EDISON TO ENSURE THE HEALTH AND SAFETY OF EMPLOYEES AND CONTRACTORS WORKING IN ELECTRICAL ENCLOSED SPACES. This procedure discusses entry into ***electrical enclosed spaces***, including requirements for testing the atmosphere, training, ventilation, and monitoring.

2.0 APPLICABILITY

This Corporate Environmental, Health and Safety Procedure (CEHSP) applies to all Con Edison employees and contractors working under Con Edison oversight (defined as “contractors” for this CEHSP), who work in electrical enclosed spaces used for the operation and maintenance of electric power generation, transmission, and distribution lines and equipment, including fiber-optic equipment associated with these electrical systems.

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For outside agencies such as public improvement, that are not under contract with Con Edison, the Con Edison organization serving as the primary contact must inform the agency's project supervision of the relevant safety precautions to be taken when working in Con Edison facilities that meet the definition of an electrical enclosed space under Occupational Safety and Health Act (OSHA) regulations. The communication of the potential hazards and relevant safety precautions to the agency must be documented.

3.0 INTRODUCTION

This CEHSP identifies the procedures for inspection, entry and work in electrical enclosed spaces. Spaces that are not designed for entry under normal operating conditions are not considered to be electrical enclosed spaces for the purposes of this procedure. In addition, spaces that are expected to contain a ***hazardous atmosphere*** are not considered to be electrical enclosed spaces. These spaces are instead addressed as ***permit-required confined spaces***.

This procedure does not address practices in permit-required confined spaces, ***gas enclosed spaces*** (working spaces such as gas manholes) and similar structures not associated with electric power generation, transmission, and distribution. Entry into these spaces must be performed in accordance with applicable CEHSPs. Permit-required confined spaces are addressed in CEHSP S16.00, *Permit-Required Confined Space Program,* and gas enclosed spaces are addressed in CEHSP S17.02, *Gas Enclosed Spaces.*

4.0 COMPLIANCE REQUIREMENTS

4.1 JOB BRIEFINGS

The lead or more knowledgeable employee must conduct a job briefing with the employees involved before they start the job. The briefing must cover: the hazards associated with the job; work procedures involved; special precautions; energy source controls; and personal protective equipment (PPE) requirements. The procedures covered will include personal escape and rescue plans based on the configuration of the enclosed space and address proper emergency contacts Additional briefings must be held if significant changes that might affect the safety of the employees occur during the course of the work. For example, the arrival of other personnel to perform work that could affect an ongoing job at a given location triggers the requirement for additional briefings. Job briefings must be documented [1] R

4.2 VEHICULAR OR PEDESTRIAN TRAFFIC

Prior to the performance of work, protection of enclosed space entry work areas must be planned, using the current Con Edison *Work Area Protection and Traffic Control Field Manual,* to avoid vehicular and pedestrian traffic hazards. [2] R

4.3 PRE-ENTRY INSPECTION

4.3.1 Evaluation of Potential Hazards

Before an entrance cover to an enclosed space is removed, it must be determined that removal can be done safely and that the condition of the electrical facilities contained therein is sufficient to allow unrestricted access and emergency rescue. The initial inspection must be conducted by a ***qualified*** Con Edison employee or equivalently trained individual and must include:

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1) Testing for stray voltage on the frame, cover, or grating, in accordance with OJT ELE0020.

2) Checking whether the cover is above “normal”, expected temperature.

3) Gradually loosening the cover if it is fastened in place, to release any residual pressure.

4) Determining whether there might be a hazardous atmosphere in the space, or whether conditions at the site could cause a hazardous atmosphere, such as an oxygen deficient or flammable atmosphere to develop within the space. This includes the oxygen level, presence of a flammable atmosphere, carbon monoxide levels, and if applicable, other toxic contaminants. Where vented manholes are present, the vent holes must be used to test the atmosphere. If an atmosphere is potentially in the flammable range or above the upper explosive limit and if it is determined that the cover must be removed, it must be done without creating a spark.

Any conditions making it unsafe to remove the cover must be eliminated before the cover is removed (that is, reduced to the extent that it is no longer unsafe). [3] R/P

4.3.2 Removal/Opening of the Cover

Appropriate tools (manhole hooks, bars, etc.) must be used to remove covers from subsurface structures. Removed covers must be place in locations that will not hinder traffic or pose a tripping hazard. When covers are removed from electrical enclosed spaces, a manhole guard consisting of a railing with appropriate toe guards, temporary cover or other barrier must be installed promptly to prevent an accidental fall through the opening and protect employees working in the space. [4] R

> **NOTE:** If, fire, smoke, explosion, or other abnormalities indicative of cable/component failure are observed, see Section 4.4.8 before approaching the trouble structure.

4.3.3 Defective Primary Cable

Where a cable in a manhole has one or more abnormalities that could lead to or that could be an indication of an impending fault, the defective cable must be de-energized before an employee may enter the manhole. This is indicated by a D-Fault tag hung in the chimney of the structure. The latest version of EO-1184, *Identifying Cable And Splice Abnormalities On Distribution Feeders* or CE-TI-6832, *Procedure For A Quick Visual Inspection (QVI) on the 69 KV and 138 KV Low and Medium Pressure Insulating Fluid Filled Cable Systems*, must be followed in all cases involving D-Faults. Abnormalities, such as oil or compound leaking from cables or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints that are swollen beyond normal tolerance are presumed to lead to or be an indication of an impending fault. [5] R

4.4 ATMOSPHERIC TESTING

Atmospheric testing is required prior to space entry for the following reasons:

- To evaluate the hazards and verify that acceptable conditions for entry exist.
- To ensure that acceptable conditions are maintained during the entry work.

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4.4.1 Initial Instrument Checks

An atmospheric monitor must be available at the site with a functioning pump or pump adapter and sufficient length of tubing to reach the bottom of the structure. Prior to testing the atmosphere of the structure, the following steps are required:

- Condition Check - Turn on the monitor to confirm working condition, and to confirm sufficient charge for the scheduled work (or confirm that a charger is available and can be used to ensure continuous monitoring during entry period(s).

- Fresh Air Check - Check the atmospheric reading in clean air (not inside the structure, and away from any vehicle exhaust or smoke) for each sensor. Confirm that the readings fall within the tolerances of

  Oxygen – 20.6% to 21.2%
  Carbon Monoxide - -5 ppm to 5 ppm
  LEL - -3.0% to 3.0%
  H2S (if installed) - -2.0 to 2.0 ppm

  If not, secure a different instrument or recalibrate that instrument, and recheck.

- Pump Integrity Check - With the pump running and hose attached, block the end of the hose with your thumb or finger. Within a few seconds the "pump flow fault" alarm should trigger, indicating that no air can flow as your pump and hose have no leaks. You must confirm that this triggers the pump flow fault before proceeding.

4.4.2 Order of Testing

All structures must be tested according to Attachment 1 prior to entry.

The internal atmosphere must be tested using an approved, properly calibrated Atmospheric Testing Device, in the following sequence:

- Oxygen (acceptable criteria between 19.5 and 23.0%). Oxygen monitoring equipment must be set to alarm if the oxygen content falls below 19.5 percent, or increases above 23.0 percent.
- Flammable gases and vapors (acceptable criteria less than 10% of the lower explosive limit (LEL), i.e., a reading of less than 0.5% as calibrated against methane.
- Carbon monoxide (CO) (acceptable criteria less than 35 parts per million [ppm]).
- Tests for toxic vapors and gases, if necessary. Entry level for toxic substances must not exceed the associated OSHA Permissible Exposure Limit (PEL), regardless of the anticipated length of entry. If hydrogen sulfide (H2S) is present, follow GEHSI S17.01.02.

The readings will be documented including the time and results.

For entry into pipe type feeder manholes that are connected to sulfur hexafluoride (SF_6) equipment or manholes containing sulfur hexafluoride (SF_6) switches, the ChemLab must be contacted to perform the monitoring if there has been a fault on the feeder or equipment (as per GEHSI S17.01.03, *Entry Into Subsurface Structures Containing SF6 Potheads*, 17.01.04, *Entry*

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into SF6 Switch Structures, and 17.01.05*, Testing, Ventilation, and Monitoring Subsurface Structures*).

Where hazardous atmospheres are suspected, it is permissible to "pre-test" the space with an instrument not approved per section 4.4.3 for one or more concerns. Pre-testing is desirable to minimize the potential for damaging a space entry gas detector through overexposure. Regardless of the results and actions of any such pretest, proper testing for all concerns using an approved instrument must be performed prior to actual space entry. [6] R/P

4.4.3 Stratified Atmospheres

Following initial testing from outside the space, the atmosphere must be tested a distance of approximately four feet in the direction of travel and to each side during descent. If a sampling probe is used, the entrant's rate of progress must be slowed to accommodate the sampling speed and detector response. [7] R

4.4.4 Space Entry Gas Detector Requirements

Pre-entry atmospheric testing, and any required during-entry atmospheric testing, must only be performed using a gas detector approved by Corporate EH&S for space entry testing in accordance with CEHSP S09.03, *Preliminary Assessment and Approval of New EH&S-Related Equipment, Supplies and R&D Services*. Approved instruments must be initially calibrated by Technical Services, and must be recalibrated at least once every 90 days. Instruments with remote calibration procedures accepted by Safety & Industrial Hygiene and Technical Services can be calibrated locally; Technical Services must calibrate all other instruments. All gas detectors must have the calibration due date clearly indicated and must not be used if this date is not clearly visible. Calibration due date may be indicated by a sticker attached by Technical Services or displayed on the instrument's screen where possible.

Only personnel who have current training on the use of space entry gas detectors may use them in the field or be assigned duties that may require their use in emergency situations. Contractors must use instrumentation that meets the OSHA requirements they must also calibrate the equipment in accordance with the manufacturers instructions. [8] R/P

4.4.5 Approved Equipment

Company personnel must use EH&S-approved atmospheric monitoring equipment for compliance with the testing requirements of this CEHSP. The Drager Miniwarn and Xam-7000 units are approved for use by company personnel. Contractors may use equipment of their choosing provided the devices are appropriate for meeting the testing requirements of this CEHSP, in proper working order, and calibrated in accordance with the manufacturer's instructions. [9] P

4.4.6 Hazardous Atmosphere

Employees must not enter any enclosed space that contains a hazardous atmosphere, unless the entry is performed in accordance with CEHSP S16.00, *Permit-Required Confined Space Program.* [10] R

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4.4.7 Con Edison Initial Entry and Visual Inspection

Once the structure is initially entered, a visual inspection must be conducted for exposed live conductors, improperly sealed cable ends, visual burnouts, structural damage, D-Fault tags, environmental tags, and excessively long cable ends that could contact the structure cover/grating or metal frame. The visual inspection must be documented. In addition, abnormalities, such as oil or compound leaking from cable or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints that are swollen beyond normal tolerance are presumed to lead to or to be an indication of an impending fault. EO-1184, *Identifying Cable And Splice Abnormalities On Distribution Feeders* or CE-TI-6832, *Procedure For A Quick Visual Inspection (QVI) on the 69 KV and 138 KV Low and Medium Pressure Insulating Fluid Filled Cable Systems,* must be followed to determine when a cable must be de-energized for work in a manhole. If personnel note a "D" Fault, they must exit the structure immediately and report their findings in accordance with EO-1184 or CE-TI-6832. If a D-Fault tag, environmental tag, or any unsafe condition is found, further steps may only be taken with consent and advice of the control center and/or field supervisor. Cable inspections are not required for enclosed spaces where electrical equipment has not been previously tied into the system or for service boxes with no primary cable. [11] P

4.4.8 Entry by Con Edison Personnel Not Qualified for Electrical Work, Contractors, or Public Improvement Personnel

If entry takes place immediately after the initial inspection (see Section 4.4.6) a follow-up inspection is not required provided that the Con Edison Inspector or the contractor supervisor were on location during the initial inspection by the qualified electrical worker. If entry by non-qualified personnel (i.e., Con Edison employees not qualified for electrical work, contractors, and public improvement personnel) is not immediate but takes place within 72 hours of the initial inspection, a "follow-up inspection" must be conducted prior to each entry. The follow-up inspection must be conducted by a qualified person (Con Edison or contractor trained by Con Edison) involved in the work and include:

1) Verification that the initial inspection was performed in the specified time frame.

2) Testing for stray voltage by a qualified Con Edison employee or qualified contractor.

3) Completion of atmospheric testing as outlined in this section

4) Determination that it is safe to enter the space.

5) A visual inspection for any abnormalities previously defined.

6) Communication of inspection results and hazards to the Con Edison inspectors and the contractor supervisor.

If entry is delayed past the 72 hours, the initial inspection must be repeated per Section 4.4.6. Qualified telecommunication employees and their contractors accompanied by qualified Con Edison personnel do not need to repeat the initial inspection until 30 days has expired. Con Edison personnel not qualified for electrical work may only enter after the "follow-up" inspection is conducted by qualified personnel. Follow-up inspections must be documented. Service boxes without primary service are exempt from the initial inspection (Section 4.4.6), however, they must have the equivalent of the "follow-up inspection". This section does not apply to enclosed

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spaces or trenches where electrical equipment has not been previously tied into the system. [12] P

4.4.9 Burnouts or Electrical Failure

Only Con Edison qualified employees are authorized to complete the work identified in this paragraph. If evidence is present of cable or component failure, fire, smoke, explosion, or other abnormalities, additional PPE in the form of protective hood (C/S 684-0755) and goggles (C/S 689-3952) must be worn prior to approaching the cover and subsequent work until the burnout has been cleared. Employees responding to burnouts may remove the cover if it can be done safely. After removal of the cover, the employees must remain a safe distance away for a period of 10 minutes in the absence of a flare-up. If a flare-up occurs, the employee must remain a safe distance away until the burning stops. The hose of a power ventilator may be directed into the opening if the hose can be placed safely. After a burnout has been cleared (burnt apart or cut), the structure must be ventilated to remove gases and odors created by the burnout. [13] P

If the trouble exposure is associated with damaged primary components or cable, the hood and goggles are required at all times while in proximity to the structure until the component/cable is grounded.

4.4.10 Attendants

While work is performed in an electrical enclosed space, an attendant must always be available within oral and/or visual contact of personnel in the structure in order to render emergency assistance. The attendant is not precluded from performing other duties outside the electrical enclosed space if these duties do not distract the attendant from monitoring employees within the space. The duties of the attendant are outlined in the applicable OJT. The attendant must not be distracted from his/her duties by engaging in such activities as speaking on a cell phone, text messaging or use of other handheld devices. Other than for performing a rescue, one person must be present outside the structure to perform the attendant duties. This does not preclude more than one person entering the structure. An attendant is not precluded from reaching into an underground structure to hand an entrant tools or other job materials so long as only the hands/arms break the entry plane.

Prior to an attendant entering the space to perform rescue, he/she must notify emergency rescue support. Attendants must be trained in first aid, cardiopulmonary resuscitation (CPR), and rescue. [14] R

4.4.11 Personal Protective Equipment

The minimum personal protective equipment for Con Edison employees, contractors, and visitors for work covered in the scope of this procedure are safety shoes, hardhat, eye protection, and FR clothing (where electrical flash hazards exist, or hot work operations are conducted). If working to clear a burnout or electrical failure, see the personal protective equipment requirement in Section 4.4.8. The FR clothing requirements are outlined in CEHSP S05.03, *Personal Protective Equipment: Protective Clothing*. Entrants and attendants are required to wear a retrieval harness at all times during entry activities in underground electric distribution structures. For work in excavations that exceed 48 inches in depth and contain energized conductors (either direct buried or in ducts), entrants and attendants must wear harnesses if the work task has the potential to contact energized conductors (i.e. breaking out a manhole/service box or breaking out a concrete encased duct bank containing live electrical

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facilities). Harnesses are not required in underground electric distribution structures when the cables are not connected to the system (i.e., newly installed and not having been connected to the system yet). [15] R

4.5 MONITORING AND VENTILATION

4.5.1 Monitoring

If flammable gases or vapors or CO are detected at the alarm level or if oxygen increases/decreases beyond alarm levels, forced-air ventilation must be used during the entire period of entry to maintain oxygen at a safe level (between 19.5% and 23.0% oxygen), ensure that the concentration of combustible gases and vapors at less than 10% of the LEL (0.5% as calibrated against methane) and concentrations of CO at less than 35 ppm. If combustible gases are vapors are detected, the local control center must be notified immediately.

Continuous monitoring must be conducted to ensure that any increase in the concentration of flammable gases or vapors and/or CO that occurs is detected. This monitoring shall be conducted at a height of approximately 4 feet above the entrant(s) respective walking/working surface (s). If the structure (such as a service box) is less than 4 feet deep monitoring shall be conducted at approximately one foot below street level.

Monitoring results at the time of initial entry into the structure must be documented. Under no circumstances will a monitor be left in the structure when employees exit. Should the enclosed space be exited during the shift there is no need to repeat the initial entry monitoring and document the results provided continuous atmospheric monitoring is performed the entire shift, and the entrant and/or attendant do not leave the work zone. If continuous monitoring inside the structure is stopped for any reason during the shift (e.g. to replace battery, device removed from structure when employee exits), initial entry monitoring must be repeated and documented.

Structures must be re-tested for safe atmosphere after de-watering.

Continuous forced-air ventilation is required during hot work while making/breaking lead cable splices. For additional information on Con Edison procedures for addressing these hazards, refer to CEHSP S10.00, *Lead Management Program,* and CEHSP S15.00, *Welding, Cutting And Other Hot Work Operations.* [16] R/P

4.5.2 Ventilation

Ventilation with forced air may be necessary to eliminate or control hazardous gases or fumes that may be present in electrical enclosed spaces and to maintain an adequate supply of oxygen. The use of power ventilation, however, does not eliminate the need to perform continuous atmospheric monitoring. Personnel who enter electrical enclosed spaces for cable identification, inspection, or other minimal time periods must first perform initial atmospheric monitoring and maintain continuous monitoring throughout the entry to ensure that an enclosed atmosphere is safe.

If at any time a test indicates an unsatisfactory atmosphere, leave the manhole or vault at once. Operate the power ventilator for 10 minutes and then take a second test. (For more guidance on proper ventilation techniques refer to ELE1010). Take this test away from the output of the power ventilator. If this test indicates a satisfactory condition, the subsurface enclosure may be

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entered. If the unsatisfactory condition persists, report the matter to the supervisor or local control center. Only Con Edison-approved power ventilation equipment may be used. [17] R/P

Specific Ventilation Requirements

If continuous forced-air ventilation is used, operation of the system must begin before entry is made, and operation must be maintained to ensure that a safe atmosphere exists before employees are allowed to enter the work area. The forced-air ventilation must be directed to deliver air into the immediate area where employees are present within the electrical enclosed space and must continue until all employees leave the enclosed space. [18] R

Air Supply

The air for the continuous forced-air ventilation must be supplied from a clean source and must not increase the hazards in the electrical enclosed space. [19] R

4.6 OPEN FLAMES

If open flames are used in electrical enclosed spaces, a test for flammable gases and vapors must be made immediately before the open flame device is used (Continuous monitoring satisfies this requirement). In New York City, a certificate of fitness is required as outlined in CEHSP S14.03, *FDNY Certificates of Fitness*. [20] R

4.7 ACCESS

Employees must not climb into or out of manholes or vaults by stepping on cable or hangers. Only approved ladders that extend three feet above the surface may be used (except for fixed ladders found in vault type structures). [21] R A ladder must be placed in the electrical enclosed space at all times during work in the space, unless it is impractical due to the position of the ladder in relation to the work tasks in the structure. If impractical, then the ladder must be positioned within reaching distance of the attendant at the entrance into the space.

Note: Rack arms, stanchions, and cable hangers are designed to support the weight of cable and joints only. These items must not be used for any other load-bearing purposes.

4.8 COMMUNICATIONS

Reliable communications (visual, voice, signal line, or two-way radio) must be maintained among all employees involved in the job. If reliable communications cannot be maintained, the entry must be discontinued. The entry may continue when a reliable communication mechanism is established. [22] R

4.9 LOWERING/LIFTING EQUIPMENT

Equipment used to lower/lift materials and tools into manholes or vaults must be capable of supporting the weight to be lowered and must be checked for defects before use. Before tools or materials are lowered into a manhole or vault, employees working in the space must be clear of the area directly under the opening. [23] R

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4.10 DUCT RODS

If duct rods are used, they must be installed in the direction presenting the least hazard to employees. An employee must be stationed at the far end of the duct line being rodded to ensure that the required minimal approach distances are maintained from exposed energized parts. [24] R

4.11 CABLES

Energized cables must be carefully inspected for defects before they are moved. Energized primary cable must only be inspected/handled/moved by qualified Con Edison employees or qualified contractors. Energized joints must only be handled by Con Edison personnel or contractors fully qualified by 29 CFR 1910.269. Energized secondary cable must only be inspected/handled/moved by or under the direction of qualified Con Edison employees, or qualified contractors. Refer to EO-10130 (distribution cable) for cable moving procedures.

When multiple cables are present in a work area, the cable to be worked must be identified by electrical means, unless its identity is obvious by reasons of distinctive appearance or location or by other readily apparent means of identification. Cables other than the one being worked must be protected from damage.

When work is performed on buried cable or on cable in manholes metallic sheath bonding must be maintained or the cable sheath must be treated as energized. [25] R/P

4.12 USE OF EQUIPMENT BY CON EDISON EMPLOYEES AND/OR CONTRACTORS

Con Edison employees may use the contractor's ladders or rescue device, if visually inspected before use, and found to be in proper working order. Only Con Edison atmospheric monitoring equipment may be used by or for Con Edison employees. Contractors may use Con Edison equipment with prior approval from Con Edison personnel supervising the work. [26] P

4.13 TRAINING

Con Edison employees and contractors who enter electrical enclosed spaces for the purpose of conducting physical work, or who serve as attendants, must be trained as required for the reason for entry, including the following:

- Applicable work procedures
- First aid/CPR (SAF 0021)
- Electrical enclosed space entry procedure
- Electrical enclosed space rescue
- The hazards of electrical enclosed space entry
- The proper use of forced-air ventilation for manholes, vaults, or similar structures
- Procedures for clearing underground structures of flammable gas and vapors

All of the above topics (except first aid/CPR) are covered in OJT ELE1010, Enclosed Space Entry and Rescue and in various skill courses.

Employees subject to entering manholes where SF_6 may be present must receive the following additional training:

- Properties of SF_6
- Nature and composition of the solid and gaseous decomposition products
- Appropriate precautions to be taken. [27] R/P

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4.14 ELECTRICAL ENCLOSED SPACE RESCUE

Examples of situations that may require rescue or resuscitation include but are not limited to:

- Illness (of a degree to preclude self-rescue).
- Injury (burns or fractures).
- Unconsciousness (physical blow, electric shock, or heart attack).

Retrieval equipment must be inspected to ensure proper function, and be available outside of the truck at the job site prior to the start of work. Before the actual work tasks begin, the retrieval device must be set up at the space entrance, or nearby so that employees can be promptly and safely extracted from the space. The placement of the retrieval device will be determined during the job briefing, based on potential hazards in the space and around the work area. For structures less than 48" in depth, the retrieval device does not have to be set up. When placing grounds on a transformer where the top of the transformer is within 48" of the grating, the retrieval device does not have to be set up.

The preferred placement of the self-supporting extraction device is always at the structure opening, in position to facilitate immediate use for rescue. If the work area cannot be configured to support this placement, the device may be positioned elsewhere inside the work area, but personnel must ensure that they have identified the location where the device would be set up to facilitate rescue, and maintain that area free of material/equipment.

A ladder must be placed in the electrical enclosed space at all times during work in the space, unless it is impractical due to the position of the ladder in relation to the work tasks in the structure. If impractical, then the ladder must be positioned within reaching distance of the attendant at the entrance into the space.

For multiple entrants in an enclosed space, the same rescue method shall be employed for each person. If both entrants are simultaneously injured, the rescue priority will be based upon first aid training.
[28] R

5.0 DEFINITIONS

Attendant: An individual authorized by the management of his/her department who is stationed outside an enclosed or other space to monitor the authorized entrants and perform all duties assigned in this program, including providing assistance to employees inside the space.

Confined Space: A space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work, and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry), and
- Is not designed for continuous employee occupancy.

Confined spaces include, but are not limited to pits, sumps, sewers, manholes, wells, tanks/tankers, boilers and pressure vessels, other vessels, and equipment.

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Electrical Enclosed Space: A working space, such as a manhole, vault, tunnel, service box, or shaft, used for the operation and maintenance of electric power generation, transmission, and distribution lines and equipment. An electrical enclosed space has a limited means of egress or entry, and is designed for periodic employee entry under normal operating conditions. Under normal conditions, an electrical enclosed space does not contain a hazardous atmosphere, but may contain a hazardous atmosphere under abnormal conditions.

Gas Enclosed Space: A working space used solely for the maintenance and distribution of natural gas lines and equipment, such as a manhole, vault, tunnel, or shaft. A gas-enclosed space has a limited means of egress or entry, and is designed for periodic employee entry under normal operating conditions. Under normal conditions, a gas-enclosed space does not contain a hazardous atmosphere, but may contain a hazardous atmosphere under abnormal conditions.

Hazardous Atmosphere: An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, unaided from an enclosed space), injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10% of its ***lower explosive limit [LEL]*** (0.5% as calibrated against methane).
- Atmospheric oxygen concentration below 19.5% or above 23.0%.
- Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in The Occupational Safety and Health Administration General Industry Standard (29 CFR 1910.1000) and which could result in employee exposure in excess of its dose or permissible exposure limit.
- Any other atmospheric condition that is ***immediately dangerous to life or health (IDLH).***

Immediately Dangerous to Life or Health (IDLH): Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a dangerous atmosphere.

Lower Explosive Limit (LEL): The lower limit of flammability of a gas or vapor at ordinary ambient temperatures expressed by a percentage of the gas or vapor in air by volume.

Permit-Required Confined Space: A confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section.
- Contains any other recognized serious safety or health hazard.

Qualified: Qualified is defined in this CEHSP with respect to employees, workers, or contractors as being trained and knowledgeable in the procedures, potential hazards, and appropriate safety measures relevant to the work the person is required to perform.

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6.0 RESPONSIBILITIES

Chem Lab: The Chem Lab is responsible for providing clearances for entering an enclosed space that may contain SF_6 gas or SF_6 by-products.

Electric Construction Group: The Electric Construction Group is responsible for installing and maintaining caution signs for SF_6 enclosed spaces.

Employees: Con Edison employees working in subsurface structures are responsible for following the requirements of this CEHSP and for attending required training.

Environment, Health, and Safety (EH&S): EH&S performs the following functions:

- Reviews applicable regulations and ensures that procedures meet all regulatory requirements.
- Revises procedures as applicable.
- Distributes updates and changes.
- Reviews training prepared by The Learning Center.
- Provides technical assistance to line management and the field.

In addition, the Director of EH&S Safety and Industrial Hygiene provides advice and counsel on this procedure.

Facility, Site, EHS; or Field Manager Responsible for Compliance: The Con Edison designated individual within each operating department who is responsible for ensuring compliance with federal, state, and local regulations, and this procedure.

Law Department: The Law Department assists and provides guidance to EH&S by reviewing changes to these procedures in light of all applicable statutes and regulations to ensure that the procedures meet all legal requirements.

Operating Departments: Unless otherwise indicated, operating departments (Customer Operations, Electric, Gas, Purchasing and CFS, Steam, and Systems & Transmission Operation [S&TO]) are responsible for compliance with federal, state, and local regulations, and this procedure.

Supervisors: Supervisors are responsible for ensuring that personnel follow proper procedures and for performing necessary training.

7.0 REFERENCES

4.1 JOB BRIEFINGS

[1] 29 CFR 1910.269(c) (job briefing). NOTE: The cited regulation does not require that completion of job briefings be documented. Con Edison requires such documentation as a matter of policy.

4.2 VEHICULAR OR PEDESTRIAN TRAFFIC

[2] 29 CFR 1926.200 (accident prevention signs and tags).

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4.3 PRE-ENTRY INSPECTION

[3] 29 CFR 1910.269(e)(4) (evaluation of potential hazards). NOTE: The cited regulation discusses potential hazards relating to atmospheric pressure, temperature differences, and hazardous atmosphere generally. Con Edison included additional evaluation measures as a matter of policy to enhance employee safety.

[4] 29 CFR 1910.269(e)(5) (removal of covers). NOTE: The cited regulation addresses the removal of covers generally; Con Edison requires the use of appropriate tools as a matter of policy.

[5] 29 CFR 1910.269(t)(7) (defective cables). NOTE: The cited regulation includes exceptions to the requirement that defective cable be de-energized before employees enter a manhole. Con Edison does not allow these exceptions as a matter of policy. Also, the CEHSP identifies Con Edison-specific procedures addressing D-Faults.

4.4 ATMOSPHERIC TESTING

[6] 29 CFR 1910.269(e)(8) (calibration of test instruments); 1910.269(e)(9) (testing for oxygen deficiency); 29 CFR 1910.269(e)(10) (testing for flammable gases); 29 CFR 1910.269(x) (definition of hazardous atmosphere). NOTE: The cited regulations address atmospheric testing generally. Con Edison has adopted additional testing requirements, including a requirement that test results be documented, as a matter of policy.

[7] 29 CFR 1910.146, Appendix B, Sec. 4 (testing stratified atmospheres).

[8] NOTE: The electrical enclosed space regulations do not address use of space entry gas detectors except as identified in Note 6 above. Con Edison has developed these procedures for calibration and use of gas detectors as a matter of policy.

[9] NOTE: The electrical enclosed space regulations do not address approval of space entry gas detectors and use of detectors for survey purposes. Con Edison has developed these procedures as a matter of policy.

[10] 29 CFR 1910.269(e)(6) (hazardous atmosphere).

[11] NOTE: The electrical enclosed space regulations do not require documented visual inspections once personnel enter an electrical enclosed space. Con Edison has developed these procedures to ensure the safety of its employees.

[12] NOTE: The electrical enclosed space regulations do not contain specific procedures addressing entry of nonqualified personnel. Con Edison has developed these procedures to ensure the safety of Con Edison personnel not qualified for electrical work, contractors and public improvement personnel entering such spaces.

[13] NOTE: The electrical enclosed space regulations do not contain special procedures to address burnouts or electrical failures. Con Edison has developed these procedures to ensure the safety of employees responding to such incidents.

[14] 29 CFR 1910.269(e)(2) (attendant training); 1910.269(e)(7) (attendants generally); 1910.269(t)(3) (attendants for manholes).

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[15] 29 CFR 1910.269(g) (requires PPE to meet requirements of 40 CFR Part 1910, subpart I).

4.5 MONITORING AND VENTILATION

[16] 29 CFR 1910.269(e)(11) (ventilation and monitoring); 1910.269(e)(12) (specific ventilation requirements). NOTE: The cited regulations address ventilation and monitoring generally. Con Edison has adopted additional requirements, including a requirement that monitoring be documented, as a matter of policy.

[17] See Note 16 above.

[18] 29 CFR 1910.269(e)(12) (specific ventilation requirements).

[19] 29 CFR 1910.269(e)(13) (air supply).

4.6 Open Flame

[20] 29 CFR 1910.269(e)(14) (open flames). See CEHSP S14.03, *FDNY Certificates of Fitness* for additional requirements.

4.7 ACCESS

[21] 29 CFR 1910.269(h)(1) (ladders, platforms, step bolts, and manhole steps); 1910.269(t)(1) (access).

4.8 COMMUNICATIONS

[22] 29 CFR 1910.269(t)(3)(iv) (reliable communication).

4.9 LOWERING EQUIPMENT

[23] 29 CFR 1910.269(t)(2) (lowering equipment into manhole).

4.10 DUCT RODS

[24] 29 CFR 1910.269(t)(4) (duct rods).

4.11 CABLES

[25] 29 CFR 1910.269(t)(5) (multiple cables); 1910.269(t)(6) (moving cables); 1910.269(t)(8) (sheath continuity). NOTE: The CEHSP includes Con Edison-specific details regarding cable moving.

4.12 USE OF EQUIPMENT BY CON EDISON EMPLOYEES AND/OR CONTRACTORS

[26] NOTE: These procedures clarify when Con Edison employees and contractors can use each other's equipment.

4.13 TRAINING

[27] 29 CFR 1910.269(a)(2) (training generally); 1910.269(e)(2) (enclosed space training, including attendants). NOTE: The training outlined in the CEHSP was developed to

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satisfy the requirements of 29 CFR 1910.269 and other regulations applicable to employees entering electrical enclosed spaces.

4.14 ELECTRICAL ENCLOSED SPACE RESCUE

[28] 29 CFR 1910.269(e)(3) (rescue equipment).

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REVISION HISTORY

Revision Date	Revision #	Summary of Change	Author
1/3/2014	18	Clarified personal protective requirements for individuals that will be in proximity to underground structures containing faulted primary equipment. (see 4.3.2, and 4.4.8) Updated atmospheric monitoring requirements to reflect addition of the Drager Xam-7000 as an approved device, and clarified existing contractor requirements (see 4.4.4) Added a specific example to illustrate a requirement for additional job briefings during ongoing work. (see 4.1)	G. Slintak
4/23/2014	19	Added (Section 4.4.1 Initial Instrument Checks) the requirement for a fresh air test as well as an integrity test on the sampling hose to the procedure.	K. Reinhart

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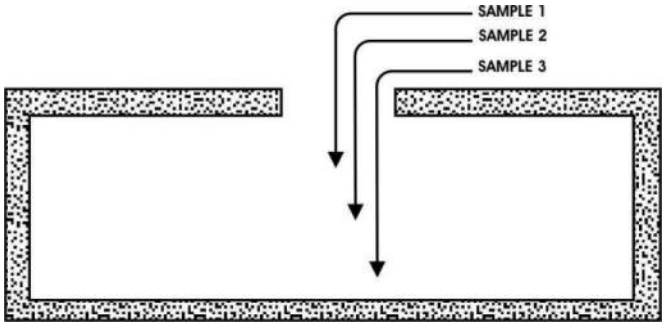
ATTACHMENT 1

SAMPLING PROCEDURE FOR MANHOLE ATMOSPHERES

Detector must first be operated in fresh air. Initial test is for oxygen deficiency followed by a gas detection test.

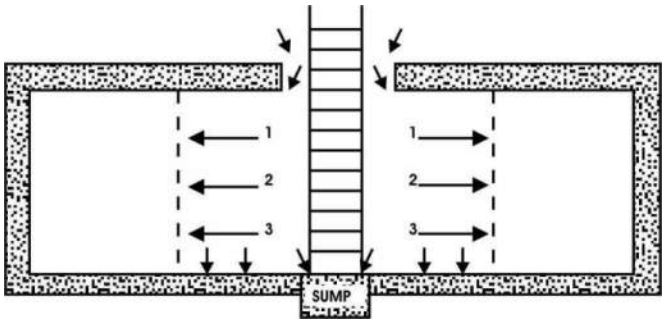
STEP 1

Observations of the atmosphere in the manhole shall be made at a level approximately two feet from the top, near the middle of the manhole, and at a level near the bottom. If water is present in the manhole, the latter observation must be made at a level just above the surface of the water. Care must be taken not to immerse the end of the sampling hose in water. When exposed to water, the filter at the end of the sampling hose will automatically close to prevent any material or gas from entering the instrument. This action will also render the instrument inoperable until the filter is replaced. To prevent erroneous readings, operating difficulties and maintenance problems, always use the probe and filter supplied with each gas detector.



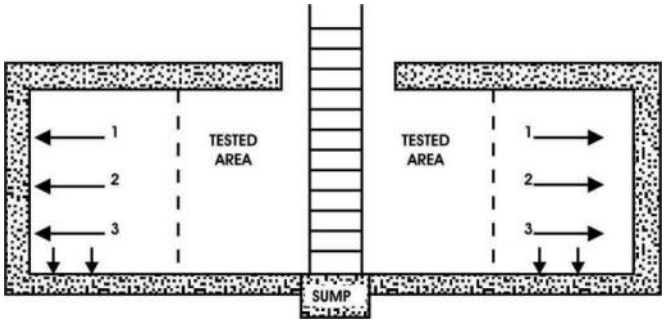
STEP 2

Insert ladder into structure and take sample around casting and chimney. While descending the ladder, take samples to the right and left for three levels



STEP 3

Check the remainder of the manhole from the tested area

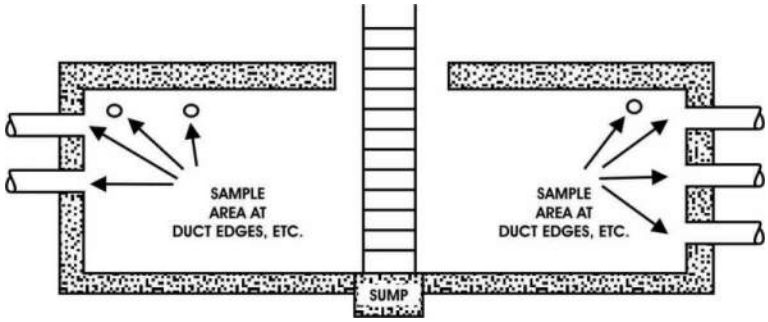


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STEP 4

Check the remaining interior of the structure at corners, cracks, and other irregularities. Duct edges shall also be checked without removing duct seal, foam, cement, or other packing materials. If possible, readings shall also, be performed up the ducts a distance of approximately 2 inches past the plane of the manhole wall.



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CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURE

CEHSP A28.00 – Calling A Time Out
Revision 5: 11/11/2014 Effective Date: 01/01/2015

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SECTION 7.0 – REFERENCES

1.0 PURPOSE

IT IS THE POLICY OF CON EDISON TO MINIMIZE ENVIRONMENTAL, HEALTH AND SAFETY (EH&S) CONCERNS WHENEVER POSSIBLE. This procedure outlines the process for calling a ***Time Out*** or work stoppage due to a safety, health and/or an environmental concern and resolving the Time Out before proceeding with work.

2.0 APPLICABILITY

This Environmental, Health and Safety Procedure (EHSP) applies to all Con Edison employees and contractors.

3.0 INTRODUCTION

The company's commitment to EH&S excellence requires that all work proceed only if it is safe and environmentally sound. The responsibility for fulfilling this requirement rests with every employee and contractor. Success depends on open communication between individuals and their supervisors prior to beginning work, and – in certain cases – after EH&S issues are identified.

4.0 COMPLIANCE REQUIREMENTS

4.1 CALLING A TIME OUT

All work shifts must begin with a job briefing in which safety, health, and environmental issues are discussed. If an employee has an EH&S concern, he/she must discuss it with his/her supervisor before proceeding with the job. Work cannot not start until both supervisor and employees agree that all EH&S concerns are resolved.

When a safety, health, and/or environmental concern arises on a job, the concerned employee must stop the work in question and immediately contact his/her supervisor to provide

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information regarding the nature of the hazard or EH&S-related concern. The supervisor must discuss the concern with the employee, either in person or on the phone, and attempt to resolve it. If the concern is resolved to the satisfaction of the employee and the supervisor and if there is certainty that all safety, health, and environmental procedures are being followed, the work may continue. If the concern is not resolved to the satisfaction of the employee and/or supervisor, work is to remain stopped and the employee must call a Time Out. In order to call a Time Out, the employee must clearly state the words "Time Out." The employee does not need to have a Time Out card in their possession in order to call a Time Out. The Time Out applies only to the location and the work related to EH&S Concern; there are no system-wide or company-wide Time Outs.

4.2 RESOLVING A TIME OUT

Once a "Time Out" is called, the following process must be followed to resolve the concerns:

- The local EH&S representative is to be contacted to obtain assistance in resolving the concern. For support groups working in the field, their organization's contact person must also be notified. The local EH&S representative will act as the authority (expert) related to health, safety, and environmental rules, regulations, and procedures and either make a determination on the merits of the concern or contact an appropriate Subject Matter Expert (SME) from other areas of the company, including, but not limited to Engineering, Corporate EH&S, or Operations. In general, the number of people involved in the Time Out must be kept to the minimum required to resolve the issue. If the local EH&S representative understands all of the issues involved in the Time Out and all EH&S concerns are addressed, the local EH&S representative's determination is final and the Time Out is concluded.

- When the local EH&S representative determines that support is needed from a company SME, the SME will serve as the final arbiter of the Time Out. In this instance, once all EH&S concerns are addressed, the SME's decision is final and the Time Out is closed.

- In either case, whether the local EH&S representative or the SME is called, once the EH&S concern is evaluated and either it is determined that no safety, health or environmental issue exists or that the EH&S concern has been mitigated, the employees are expected to return to work.

- If the local EH&S representative cannot be reached, the job cannot continue until EH&S intervention is obtained. The EH&S Control Desk can be used either to directly resolve the issue or to reach another EH&S representative who can. Furthermore, any person listed on the ***Time Out card*** may be called to resolve the issue.

- Pending resolution of the Time Out, in emergency and other situations where extensive job and procedural reviews are necessary to resolve the concerns, an alternate work plan (where practical) approved by the responsible SME will be implemented to complete the job. Before proceeding with any work prior to the resolution of the "Time Out," the Operating Supervisor and the local EH&S representative must ensure that the work will be performed in full accord with EH&S procedures, that all rules and regulations will be followed, and that safety, health, and environmental risks will be minimized.

At the conclusion of all "Time Out" situations, it must be clearly stated to all those involved that the "Time Out" is over.

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When an EH&S concern has been raised, the employee and supervisor have resolved the issue themselves, and work has proceeded, the supervisor must notify the local EH&S representative if the concern was significant or could recur. In all Time Out situations, the EH&S representative will review the incident in a timely manner, determine if the Time Out has implications outside the organization/area where it occurred, and take appropriate steps to prevent its recurrence.

4.3 TIME OUT SAFETY TALK

To ensure that all employees are familiar with and understand the Time Out Program, a safety talk (SAF7240) must be provided.

4.4 TIME OUT CARD

Each organization must issue a Time Out card to all of its employees. An employee does not need to have a card in their possession to call a Time Out. All cards must be green and white, approximately 3-1/2 inches by 2 inches, and include the following information, at a minimum:

SIDE 1	SIDE 2
You Can Always Call a Time Out	Operating Area Location/Organization
If you have a safety, health, and/or environmental question and/or concern, we are available 24 hours a day for assistance.	No job proceeds until it is made safe and environmentally sound
Con Edison Picture of "Referee"	List names and telephone numbers of local EH&S staff or Call the Control Center at (xxx) xxx-xxxx, to reach a Safety or Environmental Specialist to assist you

5.0 DEFINITIONS

Time Out: Mechanism for any company employee to stop a job if he or she is unsure of how to proceed because of a safety, health or environmental concern. A Time Out can only be called if the concern cannot be resolved to the satisfaction of the employee and supervisor.

Time Out Card*:* A green and white card, approximately 3-1/2 inches by 2 inches, issued to all company employees for the purpose of calling a Time Out.

6.0 RESPONSIBILITIES

Employees**:** Employees are responsible for discussing EH&S concerns with their operating supervisors and calling a Time Out, when appropriate.

Local EH&S Representative: The local EH&S representative is the operating department's EH&S manager or one of his/her staff members. The local EH&S representative is responsible for:

- Determining the merits of EH&S issues identified by operating supervisors and resolving Time Outs, if possible.

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- Contacting the appropriate SME if additional guidance is needed.

Operating Supervisor: The operating supervisor is a supervisor in an operating department with that title or any other supervisor in another department. The operating supervisor is responsible for:

- Attempting to resolve EH&S concerns raised by employees.
- Contacting the local EH&S representative if the employee EH&S concern cannot be resolved.
- Assessing the significance of any EH&S concerns raised and notifying the local EH&S representative of concerns that are significant or are likely to recur.

Subject Matter Expert: The SME is an individual who has detailed, specific knowledge on a particular subject by the nature of his/her education, training and experience. The SME is responsible for:

- Providing assistance to the local EH&S representative in resolving Time Outs.
- Serving as final arbiter of Time Outs.
- Approving alternate work plans, where necessary

EH&S Control Desk If the local EH&S representative cannot be reached, the EH&S Control Desk is responsible for directly resolving the Time Out or reaching another EH&S representative who can.

7.0 REFERENCES

This CEHSP was developed by Con Edison as a matter of policy to ensure open communication about, and prompt resolution of EH&S issues arising on the job.

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REVISION HISTORY

Revision Date	Revision #	Summary of Change	Author
11/11/2014	5	Periodic review with the following minor changes: • Updated ERTs to EH&S Control Desk; • Added statement "Work cannot not start until both supervisor and employees agree that all EH&S concerns are resolved"; • Removed 'Corporate' from Corporate Environmental Health and Safety Procedures.	W.K Capune

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REVISION HISTORY

Revision Date	Revision #	Summary of Change	Author

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CORPORATE ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURE

CEHSP A32.00 – Rules We Live By
Revision Date: 12/31/2015 Effective Date: 01/31/2016

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- 4.1.3 – REPORTING AND INVESTIGATION
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- 4.3 – DEFINITIONS

RULES WE LIVE BY TABLE

1.0 PURPOSE

This procedure establishes a consistent approach to communicating and reinforcing the importance of following critical safety work practices designed to protect employees, contractors, and the public.

2.0 APPLICABILITY

This Environmental, Health and Safety Procedure (CEHSP) applies to all Con Edison employees (management and union) and contractor employees working for Con Edison.

3.0 INTRODUCTION

There are safety and operational procedures specifically designed to protect against the potential for significant injury due to the energy (electricity, gas, steam, or falling from elevation) that must be controlled. Operating groups that work with these sources of energy have identified Rules We Live By. At The Learning Center, the RWLB associated with a given activity of an operating department apply. This is defined as a work procedure or safety requirement that, if not followed, could result in a severe injury or fatality, or place other individuals (employees or members of the public) at significant risk.

4.0 COMPLIANCE REQUIREMENTS

4.1 RULES WE LIVE BY IDENTIFICATION, TRAINING, AND REPORTING

4.1.1 IDENTIFICATION

Where work tasks require the safe control of electricity, gas, steam, or work at elevation, the operating organization must identify key procedures required to control the energy or mitigate the

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effect or impact onto the employee, fellow employees, contractor employees or the public. Lessons learned from previous incidents must be included in the identification process.

An organization must notify Corporate EH&S of any change to a Rule.

4.1.2 TRAINING AND COMMUNICATION

An organization's Rules We Live By and associated procedures must be reinforced in applicable skills training.

Each employee in the organization must receive OJT training on the Rules We Live By identified by the organization.

Rules We Live By must be reinforced, when applicable, in job briefings.

Rules We Live By must be incorporated into the scope of safety field observations and inspections.

Where contractor work practices involve Rules We Live By, contractor employees will be trained on the applicable Rules We Live By, reporting procedure, and consequences. The operating organization must communicate the applicable Rules to contractor management and ensure the Rules are incorporated in the HASP. The contractor supervisor will be required to train their affected employees and subcontractor employees before they begin work.

4.1.3 REPORTING AND INVESTIGATION

If a supervisor observes a Rule We Live By being violated, the work must be stopped immediately.

If an employee, not a supervisor, believes a Rule We Live By may have been violated, he/she must stop the work immediately and report the situation to the supervisor of the employee who committed the alleged violation.

Resolution of the alleged violation must follow the Time Out process as defined in CEHSP A28.00 – Calling a Time Out.

4.2 VIOLATION OF A RULE WE LIVE BY

A violation of a Rule We Live By will result in significant consequences.

Any employee who witnesses a violation of a Rule We Live By and does not stop the work and report the violation will also be considered to have violated the Rule.

A violation by a contractor company or by a sub-contractor must be reported via an action line by the operating organization with contractor oversight.

The organization must notify EH&S after action has been taken as a result of the violation.

4.3 DEFINITIONS

Con Edison employee: This includes all management and union employees.

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Contractor employee: This includes all per-diem contractor employees and those employees working for a contractor company hired by Con Edison.

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REVISION HISTORY

Revision Date	Revision #	Summary of Change	Author
1/21/14	2013 Annual Review	*CEHSP A32.00.01 RWLB - Table*: Permits, Electric Ops – Added language to clarify that entry for work in structures containing d-faulted feeders is permissible after associated source equipment has been de-energized.	G. Slintak
4/23/14	2013, Revision 1	*CEHSP A32.00.01 RWLB - Table*: Adjusted high hazard PPE rule as applied to Gas Operations in response to 4/22 request. Change clarifies the attachment point for use of PPE (previously associated with "blowing gas," a subjective term).	G. Slintak
5/16/14	2	Combined 'CEHSP A32.00 – Rules We Live By' and 'CEHSP A32.00.01 – Rules We Live By Table' into one document. The table will be an attachment to the procedure.	S. Ng
12/31/14	2014 Annual Review Rev. 3	Edits to reflect organization changes. Minor changes to clarify rules.	W. Capune
12/21/15	2015 Annual Review Rev. 4	Edits to reflect organizational changes in Shared Services. Customer Operations adopted the same language as Electric Operations for High Hazard PPE.	W. Capune

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RULES WE LIVE BY 2016

Hazard	Electric Operations	Central Operations	Gas Operations	Customer Operations	Utility Shared Services
Verify Dead/Lockout-Tag Out	Properly test or spear to ensure that electric equipment, cable, or wire is "dead" as required regardless of voltage, before beginning dead work activities.	Properly test or verify that equipment is de-energized, isolated and protected prior to initiating dead work activities.			Properly lock out/tag out equipment before beginning work on the equipment. (when not intentionally live and PPE is required)
Permits (Operating, D-faults)	Enter D-Fault tagged structures only when authorized by the operating authority to perform feeder processing, or to perform work after all D-faults have been identified and de-energized.	• Only perform work that is within the authorized scope of work as listed on the work permit. • Do not change the status of a piece of equipment that has a Stop Tag applied to it. • Follow the sequence of an operating order.		Do not enter a structure that has been classified and tagged as a D-fault.	Only perform work that is within the authorized scope of work as listed on the work permit
Atmospheric Testing	• Perform air monitoring and ventilate as required for entry and work in an enclosed space or a permit-required confined space. • For excavations greater than 4 feet in depth the atmosphere shall be tested prior to entry or when the excavation is not already occupied.	• Perform air monitoring and ventilate as required for entry and work in an enclosed space or a permit-required confined space. • For excavations greater than 4 feet in depth the atmosphere shall be tested prior to entry or when the excavation is not already occupied.	• Perform air monitoring and ventilate as required for entry and work in an enclosed space or a permit-required confined space. • For excavations greater than 4 feet in depth the atmosphere shall be tested prior to entry or when the excavation is not already occupied.	Perform air monitoring and ventilate as required for entry and work in an enclosed space or a permit-required confined space.	Perform air monitoring and ventilate as required for entry and work in an enclosed space or a permit-required confined space.
Rescue/Retrieval	Entrant and attendant are required to wear rescue harness when working in enclosed spaces.	Entrant and attendant are required to wear rescue harness when working in enclosed spaces.	Entrant and attendant working in enclosed spaces shall wear rescue harnesses, when required.	Entrant and attendant are required to wear rescue harness when working in enclosed spaces.	Entrant and attendant are required to wear rescue harness when working in enclosed spaces
High Hazard Energy PPE	• Use fall protection equipment as required. • Use appropriate rubber gloves with protective gauntlets, rubber sleeves, fire retardant clothing and eye/protection face shield as required for the electrical hazard.	• Use fall protection equipment as required. • Use appropriate rubber gloves, rubber sleeves, fire retardant clothing, and eye protection/face shield as required for the electrical hazard. • In Steam Distribution, use appropriate water resistant coveralls and face shields before disconnecting any piping from the dead side of the trap valve up to and including the trap inlet valves and trap bypass valve. These coveralls and face shields must be worn until all piping is reconnected.	• Use fall protection equipment as required. • Wear airline respirator, FR coveralls, Fr hood & FR gloves or liners as required by IP-42	• Use fall protection equipment as required. • Use appropriate rubber gloves with protective gauntlets, rubber sleeves, fire retardant clothing, and eye protection/face shield as required for electrical hazard. • Do not come into contact or move a downed or low hanging utility wire while performing Site Safety or Damage Assessment work.	• Use fall protection equipment as required • Use the appropriate rubber gloves, rubber sleeves, fire retardant clothing, and eye protection/face shield as required for the electrical hazard
Sheeting/Shoring		Ensure that excavations five feet or deeper are properly sheeted and shored before anyone enters.	Ensure that excavations five feet or deeper are properly sheeted and shored before anyone enters.		
Gas Piping Integrity Test			Perform an integrity test before a customer turn-on.	Perform an integrity test before a customer turn-on.	
Securing Loads					Reels over 5,000lbs (individually or when bundled together) are secured per NYS Metal Coil requirements

Please note: At The Learning Center, the RWLB associated with a given activity of an operating department apply.

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

1.0 INTRODUCTION

This document outlines a process to identify, locate and clear subsurface utilities as part of all Environmental Health and Safety (EH&S) 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 *Con Edison and or industry* 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, safety *and environmental* 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, *which will include surrounding/adjacent facilities and or buildings*, 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, *at a minimum,* 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 *or their designee, such as consultant or Con Edison Construction Management Inspector.* 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 *or their designee*.

2.0 REVISIONS FROM PREVIOUS VERSION

This version (**Revision 2**) *contains modifications to Revision 1 and includes additional provisions and or guidance based on lessons learned during implementation of the previous versions* 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.

- *Considerations for potential presence of fiber optics;*
- *Accessing manholes and other utilities during field inspection and utility mark out;.*
- *Considerations for potential presence of traffic control electric lines; and*
- *Considerations for potential presence of unmapped non-routine utilities or subsurface utilities, such as drainage pipes, etc.*

Modifications and additions to the text relative to the introductory sections of this document and the topics listed above are *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 *or their designee.* 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. . *When working at, adjacent to or in the immediate vicinity of a Con Edison facility ("Facility"), such as substation or gas regulator station, the Con Edison PM or their designee shall also obtain and review the Facility-specific plates. These shall include all utilities (both Con Edison and non-Con Edison) on and/or entering or leaving the Facility. Regardless of who obtains the requisite utility plates and or drawings, the Con Edison PM shall ensure that the job package is complete and includes ALL required such drawings and or plates of sub-surface facilities in the*

area(s) of intrusive activity, such as excavation or drilling. 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: Fiber optics at Con Edison facilities are not routinely identified on utility drawings. Therefore, when conducting intrusive work at Con Edison facilities, the facility engineer should be contacted in advance of the site walk to determine if fiber optic cables are known to be present and, if so, what is their layout. Fiber optic lines generally cannot be detected using routine geophysical methods accordingly, at sites with known fiber optics every effort should be made to determine their location or confirm their absence in the work area.

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 plotter located in the 2nd floor of Building 138. 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., computer, and or photocopier) are used.

Conduit and Duct Occupancy (C&DO) utility plates can also 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) *or, if in Westchester, then the drawings and or plates should be obtained from the local authority, such as the County Health Department or municipal Departments of Public Works (DPW) and or Buildings (DOB).* 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

Fiber Optics

As noted above, fiber optic lines are typically not shown Con Edison's utility drawings. Accordingly, the facility engineer should be consulted regarding the presence,and if present, their location as discussed above.

Traffic Control Cables

Drawings and or plates for subsurface traffic control facilities should be requested from New York City Department of Transportation (NYCDOT) or the local/ municipal DPW or DOT.

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 *will require a Code 753 utility survey with supplemental M-scope survey by Con Edison and or a subsurface utility survey by a private utility-locating contractor*. The applicability of each of these surveys 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) [for locating metallic **and** non-metallic pipes and cables]*
- Radio Frequency Induction (RFI) *[for locating non-metallic pipes and cables]*
- 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**, *in cooperation with the Con Edison PM and or their designee:*

1) Review **ALL** utility drawings

2) Reconcile **ALL** drawings with markouts identified by the Code 753 survey at the property perimeter.

3) Determine presence, type and nature of sub-slab utilities and diligently attempt to confirm their configuration during the utility survey.

4) Inspect the site to identify*/reconcile* where **ALL** utility service(s) 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) For work at or adjacent to Con Edison Facilities, conduct the site walk and review the facilities drawings with key Facility Management personnel.

6) Visually identify, open and inspect **ALL** relevant utility access-ways including manholes, vaults, gas and or water valves boxes and telephone, *fiber optic* cable, *traffic control lines* and communication boxes.

NOTE: Only circular manholes shall be opened. If opened improperly, rectangular manhole covers can fall into the underlying vault and damage the contained utility (e.g., transformer). If it isa anticipated that manholes will need to be opened, Con Edison Transmission and Service Operations (T&SO) shall be contacted prior to conducting the site walk and or utility clearance survey using a private locator.

7) 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, *sewer and or drain pipes,* distribution lines in manhole, *telecommunication lines,* 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 at each 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 *key Facility Management 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 mark-outs 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), private facility managers/property owners *and or owners/operators/representatives of private utilities, such as NYCDOT, municipal DPWs, Westchester Department of Sewer, Westchester County Department of Health, etc.* 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 as shown 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/trenche***s*, 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 pit***s* 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.

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.

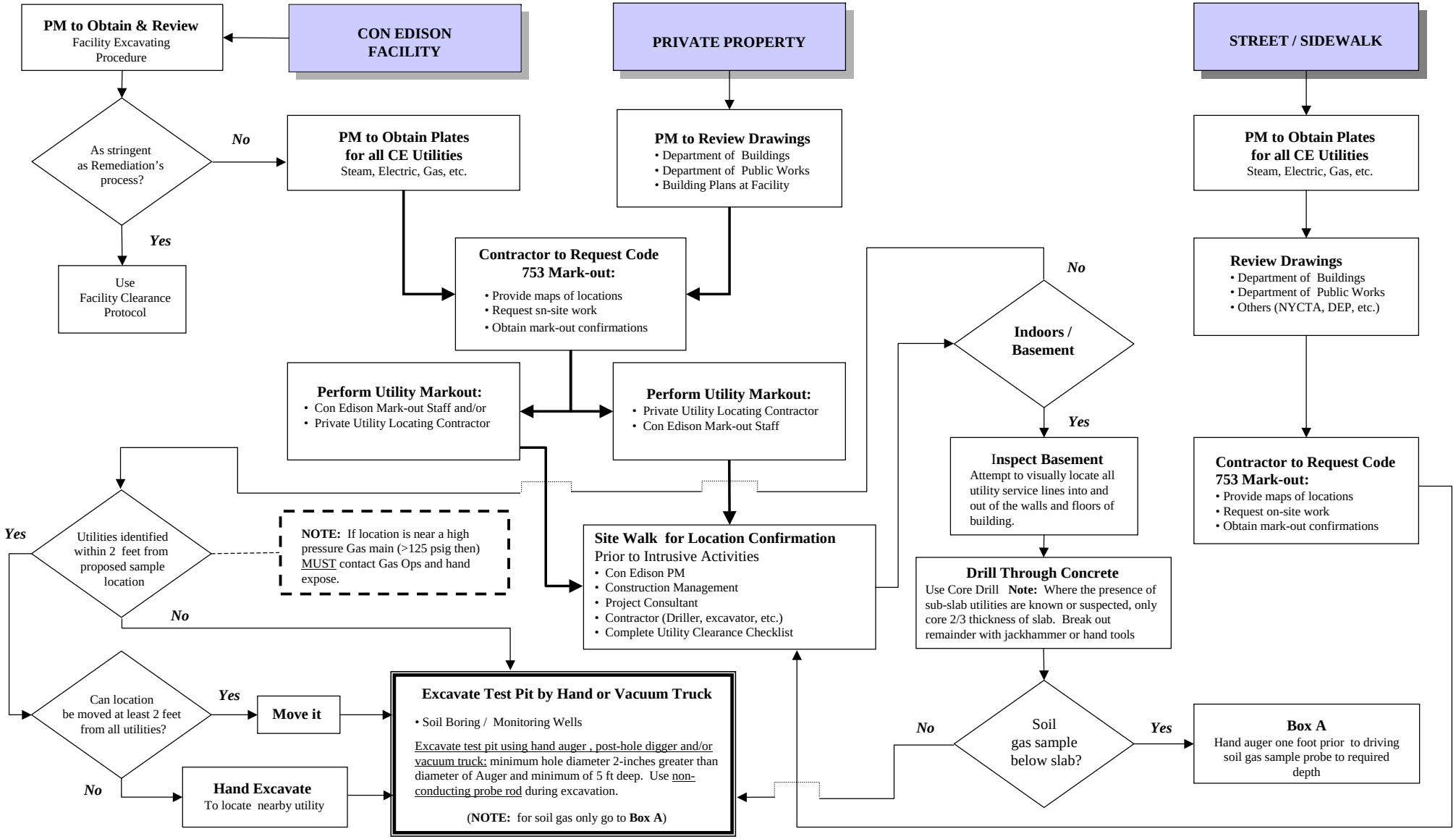
ATTACHMENT A

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: _____

CHECKLIST FOR INTRUSIVE FIELDWORK

Site Walk Sign-In Sheet

Project Name: _____

Date of Site Walk: _____

Name:	Organization:	Phone No.

ATTACHMENT C

Instructions for Obtaining Drawings for Sewer and Water Utilities

From the NYC DEP

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:

conEdison

Work Area Protection and Traffic Control

Field Manual



THE WAY WE WORK IS SAFELY

To All Con Edison Field Forces:

This is your field manual on Work Area Protection and Traffic Control. It is designed to help you achieve a safe work area for our employees, with limited obstruction to traffic, through the use of uniform traffic control devices. In addition, it provides protection for pedestrians and motorists.

This edition has been updated to comply with the current *Manual on Uniform Traffic Control Devices* (MUTCD). It is based on three fundamental principles:

- Protection for you and your coworkers while you work.
- Protection for motorists and pedestrians;
- Safe and expeditious movement of traffic around your work area.

Not all work sites, traffic, or pedestrian situations can be illustrated in this manual. Employees must apply the principles and tools covered in this manual to set up work area protection and traffic control devices with all applicable traffic regulations in mind.

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Practical and Procedural Considerations 1

Because of the vital nature of our jobs, we must gain access to areas where repair, maintenance, and construction are required. Providing a work area that is safe for everyone is of critical importance.

Basic Principles of Work Area Protection

Traffic conditions in our operating area make it necessary to plan protection for work areas to avoid vehicular and pedestrian traffic hazards, and safeguard the public and our employees.

The work area protection that you set up at the job site has two main goals:

- To provide suitable work area devices so pedestrians and drivers of vehicles are aware of work area boundaries;
- To protect you and your co-workers while you work.

In addition, when planning work area setups, an important company concern is to maintain good relations with the public while maintaining safety in the work area. Employees in the field help create goodwill by the way they conduct themselves, and by the way they arrange and maintain their work areas.

Con Edison's reputation as a good neighbor is important. Do your part to preserve it by always using the work area protection principles described in this document when you are on the job.

Plan the Work and Work the Plan

In order to work efficiently and to minimize possible disruptions for pedestrians and vehicular traffic, it's important to prepare in advance before arriving at a work location. Here are some factors to consider:

Scheduling: When scheduling street work, try to avoid hours of unusually heavy traffic.

Permits: Review the work and Department of Transportation (DOT) permit requirements before planning work. Follow DOT stipulations.

Requirements include:

- *Posting of permits to face the nearest curb line at the work area setup. Posted permits must provide the following information: name of the contractor, start and expiration dates, contact telephone number, permit number, and type of work (gas, steam, or electric system). Lettering must be 1 1/2 inches high;*
- Determining days and times to perform work;
- Securing permission for lane closings.

Efficient Deployment: Maintain street work areas only for as long as is necessary. Move in quickly and safely, do the job, and move out. Minimize obstruction and excessive exposure to traffic.

Materials: Before leaving the yard, review work orders and make sure that all equipment and supplies are available to complete the job as promptly as possible.

Evaluate the Work Area

Determine how existing conditions will affect the job, and how work area protection must be adapted to the location. The following must be considered:

Vehicular Traffic:

- Assess the volume and speed of traffic.
- Arrange in advance with the appropriate authority to shut down a traffic lane when work must be done at approaches to and exits from tunnels and bridges.
- Allow for the free passage of emergency vehicles, including fire engines and ambulances.

Pedestrian Traffic: Observe the pedestrian routes to crosswalks and bus stops.

Changes in Work Plan: Reassess protective devices and working conditions based on any changes in the traffic patterns or scope of work that may occur during the work operation.

Business Establishments and Other Public Facilities: When excavations are to be made near schools, hospitals, theaters, or large business establishments, where there is substantial pedestrian and vehicular traffic, notify customers in advance so that they will be inconvenienced as little as possible.

Work Area Considerations

Use the following parameters in your planning so that the job setup can occupy the smallest work area consistent with safe operations:

Width of Work Area: Generally should not exceed the width of one traffic lane.

Where this is not possible (e.g., excavations, manholes between two lanes), doing the job in steps should be considered. In congested areas with unusual traffic conditions, notify the local police precinct.

Length of Work Area: Should be separated from oncoming traffic by placing a tool cart, Pel bag, vehicle, or other similar barriers between the working point and oncoming traffic. For increased protection, a buffer zone (the same width as the work area) should be located in front of the work area. The area in front of the buffer zone will be used to channelize and taper traffic flow away from the work area by using traffic cones and/or stanchions.

Mobilization:

1. Day or night, before moving out into traffic lanes, operate hazard lights on the vehicle. For tool carts, mount the directional arrow signs and appropriate advance-warning flasher; and use channelizing devices (traffic cones and/or stanchions), as well as the required warning signs.
2. Warn oncoming motorists during the move into traffic lanes. When necessary, a crew member equipped with a signaling device and wearing a retroreflective vest should warn oncoming motorists.
3. If a traffic light is present, wait for the light to change before mobilizing equipment in or out of traffic lanes.
4. Some operations require work vehicles to be positioned facing oncoming traffic. Maneuvering a vehicle into such a position can present a risk to workers, the vehicle, and the public, if it is not performed using good judgment and appropriate safety equipment, i.e., a hard hat, flag, and retroreflective clothing.
5. The vehicle's hazard lights must be in operation and visible to all approaching traffic during the maneuver until the vehicle is within a protected work area.
6. Select traffic-control devices to protect the work areas.

Following Through: Setting Up the Street Work Area

In creating the work area protection setup, these elements are a part of the job-site characteristics to consider and the tools to use.

Steps to follow for setting up work area:

- Wear proper PPE (traffic vests, hard hat).
- Dome light/flashers/arrow boards.
- Position vehicle upstream from work site to begin channeling traffic.
- Flaggers to warn traffic, when necessary.
- Place advance warning sign(s); sign is first.
- Begin laying down traffic devices (e.g., cones, stanchions), working your way down to the work site.
- Continue to channel traffic using cones; determine work site termination.
- Establish work site.
- Establish work site termination with cones (downstream).
- Establish pedestrian channeling, when necessary.

Personal Protective Equipment: Employees exposed to vehicular traffic, e.g., when setting up, maintaining, removing, or working outside of work area protection, must wear hard hats and retroreflective safety apparel.

Advance-Warning Signs: Remember – oncoming drivers must be able to see the work area if they are to avoid it. Therefore, night or day, arrange your traffic-warning equipment to provide advance warning to oncoming drivers. Channelizing devices tapered to move traffic away from the work area with a series of warning signs extended in the direction of oncoming traffic must be used.

Traffic Devices: Set up the selected devices to control vehicle and pedestrian traffic and protect the work area. Provide clearly defined boundaries of street and sidewalk work areas throughout the work operation day and night.

Intersections: At intersections, place the most effective warning equipment so that it faces the heaviest oncoming traffic. Set up traffic-control devices on alternate sides of an intersection to control flow around a work area.

Lamp Reels: When taking temporary service from a lamppost, cover the open door with a lamppost apron to protect exposed wiring. (Contractors are required to use generators to obtain power.) ALWAYS lay cord along the curb. AVOID laying cord diagonally across traffic lanes. If necessary, use an extra lamp reel. Use shunt boards to cover cord and hose that protrude into pedestrian walkways or traffic lanes.

Pedestrian Passageways: Minimum must be 5-feet-wide. Where required, protect pedestrian and bus-stop passageways with barricades, planking, steel plates, or shunt boards extending well beyond the defined passageway. Use signage to indicate alternate paths and access to bus stops.

Using Wheel Chocks at Worksites: All commercially plated vehicles must be chocked within the work area.

Note: The work zone is an area with construction, maintenance, or utility activity, including on company property.

All vehicles in work area up to 26,001 Gross Vehicle Weight Rating (GVWR) require **two** chocks (including tool carts and extra machines).

Vehicles with 26,001 Gross Vehicle Weight Rating (GVWR) or greater require **four** chocks.

Using Wheel Chocks on Flat Roads: Place one chock in front and behind one rear wheel. (For vehicles with four chocks, set up front and behind both rear wheels).

Using Wheel Chocks on Inclined Roads: For vehicles set up or parked facing uphill on a job site, place chocks behind rear wheels on both sides. (Rear of front tires are to be steered on an angle toward curb shoulder where applicable).

For vehicles set up or parked downhill on a job site, place all chocks in front of rear wheels. (Steer front tires on an angle toward the curb shoulder where applicable).

Emergency brake must be in place at all times when a vehicle is stationary at a work area. Also, chocks must make contact with tires leaving no gap space.

Hazard-Vehicle Lights: If a vehicle must stand in lanes of moving traffic for work purposes and is not within a protected work area, the hazard-vehicle light(s) must be in operation day and night.

Street Openings: If it is necessary to leave street work areas unattended at night, provide traffic-control devices to include use of Type III barricades around the work area to protect motorists and pedestrians.

Plating: Provide plating or decking when required. All road plates must be pinned and ramped to avoid pedestrian foot injury or injury to motorists due to plate movement.

Floodlights: When it is dark, and when using flaggers, use flood lamps where required for additional protective illumination or work illumination. Lamp glare should not impede motorists or workers.

Subsurface Structure Openings: When opening service valve castings S1, S2, S3, 32-inch cover, or 44-inch covers for any underground structures, manhole guardrails in conjunction with telescoping rails, must be in place to prevent pedestrians from falling into the structure, and to prevent debris or other materials from entering. In addition, you must follow the appropriate entry procedures for enclosed or confined spaces. Larger sub-surface structures require type 2 barricades to be installed.

Housekeeping: Good housekeeping is an important item in street work area protection.

Demobilization of the Job:

Steps to follow for breaking down work area:

- Wear proper PPE.
- Clean up work area.
- Break down work site.
- Pick up traffic devices in reverse order.
- Work your way back toward the Advance Warning sign.

Moving Out of the Work Area

Just as with setup of the work area, proper procedures must be observed when the job is finished and the site is being cleared.

Hazard-Vehicle Lights: Traffic-warning equipment and hazard-vehicle lights must be in operation while moving from traffic lanes to the curb.

Flagger: A trained member of the crew, wearing a retroreflective vest and hard hat, should warn oncoming motorists with a signaling device where necessary.

Traffic Controls: If a traffic light is present, wait for the red light before moving out of the traffic lane.

Plates: Ensure that all road plates are left pinned and ramped to maximize public safety.

Ongoing Work: If the job is shared by another Con Edison work area setup, make sure to leave the work area protection and the setup in good condition.

Housekeeping: Before leaving the area, inspect the site to be sure that no tools, equipment, or debris are left behind. Always work the job to make the public think well of you and the company. Remember, on the job, ***you are Con Edison***.

Advance-Warning Signage and Equipment for Work Area Protection

2

The purpose of advance warning is to properly alert motorists and pedestrians to physical conditions ahead.

Note: The advance-warning area may vary from a single sign to a series of signs in advance of the temporary traffic-control zone activity area.

Signage distances may be adjusted where necessary, depending on roadway limitations or for more effective warning and guidance.

Signage must effectively warn oncoming traffic, allowing adequate time for driver response. The employee must make the judgments necessary to establish and maintain effective advance warning.

Advance-Warning Signs

Description: Warning signs must have a black legend on an orange background and be retroreflective for nighttime use. Diamond-shaped warning signs are preferred. However, where necessary, the alternate rectangular shape may be used. Minimum sizes for warning signs are 30 inches by 30 inches (diamond); 36 inches by 36 inches for conventional roads, and 48 inches by 48 inches for freeway or expressways. Rectangle sign sizes are to be 24 inches by 18 inches for conventional roads, and 36 inches by 24 inches for freeways or expressways.

Signs Displaying the Symbol of a Worker or the Words "Road Work Ahead" or "Utility Work Ahead"

Instructions for Use: These signs are required to be posted for all work done in a traffic lane, parking lane, or on a shoulder. They must be posted first and in front of channelizing devices.

The sign displaying the symbol of a worker (the "worker symbol") may be used for short-duration work areas, while the "Road Work Ahead" and "Utility Work Ahead" signs are to be used for long-duration work areas (i.e., more than three days).

The sign may be mounted on portable "crashworthy" supports and must face oncoming traffic.



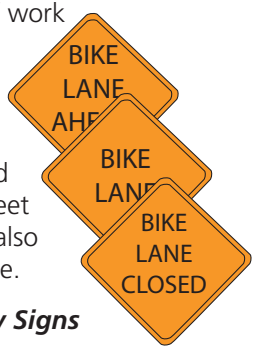
For short-duration work that occupies a location for up to three days, such as a manhole operation where workers are present or work in a parking lane, the standard distance between the warning sign and the lane closure or work area is 150 feet.

For long-duration work (more than three days), such as an excavation in a travel lane, the standard distance between the warning sign and the lane closure or work area is 300 feet.

Different distances may be used where necessary for more effective warning and guidance.

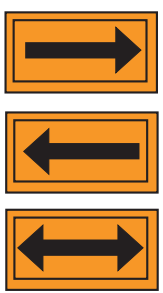
Bike Signs

"Bike Lane" signs are to be used when stipulated on the work permit issued by the city. If work is affecting a bike route/lane, a bike lane closed advance warning sign must be posted 350 feet and 200 feet prior to work, and also posted at work zone.



Directional-Arrow Signs

Description: Orange retroreflective background at least 48 inches by 24 inches for conventional roads, and 60 inches by 30 inches for expressway, with a clearly recognizable black arrow symbol. Standard or variable arrow signs (as shown) may be used.



Instructions for Use: The arrow board may be mounted on a vehicle, tool cart, barricade, or portable supports. It must be mounted at a minimum height of 1 foot to the bottom of the sign and must face in the direction of the oncoming traffic. The arrow must indicate the direction in which the traffic may pass.

Note: Arrow signs are intended to give motorists clear information and provide them with effective guidance. Therefore, care must be taken to ensure that the proper message is displayed at all times.

"Flagger Ahead" Signs

Description: The "Flagger Ahead" sign must be diamond shaped, minimum 30 inches by 30 inches, 36 inches by 36 inches conventional, 48 inches by 48 inches expressway, with a black legend and border on retroreflective orange background. It shows the silhouette of a person standing with the right arm (facing the viewer) extended horizontally and holding a flagstaff horizontally, with the flag hanging down. The free arm is shown bent with the palm above shoulder level.



Instructions for Use: The "Flagger Ahead" sign shall be placed after the worker symbol or "Road Work Ahead" or "Utility Work Ahead" sign and well before the flagging location.

Lane-Closure Signs

Description: Lane-closure warning signs must have a black legend and border on an orange retroreflective background.



Instructions for Use: Advance notice of closed lanes must be provided when work areas must interrupt the flow of traffic in through lanes. This sign should be placed after the worker symbol or "Road Work Ahead" sign and may be placed at the beginning of the taper created by the use of channelizing devices.

Road Closed Signs



Description: This is a horizontal rectangular white sign, 48 inches by 30 inches, with a black border and the words "Road Closed" in black on two lines.

Instructions for Use: The "Road Closed Ahead" sign should be used when the roadway is closed to all road users except contractors' equipment or officially authorized vehicles. This sign should be accompanied by appropriate warning and detour signage. This sign should be installed at or near the center of the roadway, on or above a Type III barricade that closes the roadway.

Note: New York City requires closed-street permits from the DOT. Both the police department and the fire department's communications center require notification 24 hours in advance of nonemergency street closings. The local community planning board requires a notification seven days in advance when closing more than 50% of moving lanes per direction. Westchester permits vary by municipality.

"Sidewalk Closed" Signs

Description: This device is used when a sidewalk must be closed in order to conduct work. This is a visual indicator to notify pedestrians that passage though this area is prohibited. Provisions must also be made to indicate redirection of pedestrian traffic.

Persons With Visual Disabilities

Adequate provisions, as determined by an engineering study or by engineering judgment, should be made for persons with visual disabilities. Because printed signs and surface delineations are not accessible to pedestrians with visual disabilities, blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing the following: audible information devices, accessible pedestrian signals, and barriers and channelizing devices that are detectable to pedestrians who have low vision or who are traveling with the aid of a long cane. The following three items should be considered when planning for pedestrians:

A. Pedestrians should not be led into conflicts with work site vehicles, equipment, and operations.

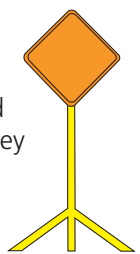
B. Pedestrians should not be led into conflicts with vehicles moving through or around the work site.

C. Pedestrians should be provided with a reasonably safe, convenient, and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or foot path(s). Where pedestrians who have visual disabilities encounter work sites that require them to cross the roadway to find an accessible route, instructions

should be provided using an audible information device. Accessible pedestrian signals with accessible pedestrian detectors might be needed to enable pedestrians with visual disabilities to cross wide or heavily traveled roadways. A pedestrian route should not be severed and/or moved for nonconstruction activities, such as parking for vehicles and equipment.

High-Level Warning Devices

These devices are used in addition to signage. They can be lighted or unlighted as described below, and they provide clear, highly visible warning of the work area for both pedestrians and vehicles.



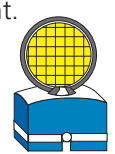
Flag Trees

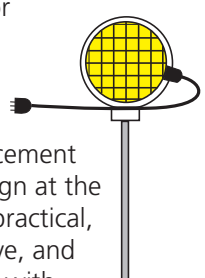
Description: The flag tree should display a minimum of two 16 inches by 16 inches flags with their lowest corners at a height of 8 feet. Other warning signs may be mounted below the flags to alert and warn traffic in advance of a work area during daylight hours.

Instructions for Use: At work areas where the placement of the advance-warning sign at the standard distances is not practical or is found to be ineffective, a flag tree may be used in conjunction with a worker symbol or road work ahead sign in advance of the work area (also in advance of any arrow boards) to effectively warn traffic. It must be placed at a sufficient distance in front of the work area to warn oncoming drivers.

Advance-Warning Flasher: Type B High-Intensity Flashing Warning Lights

Description: The high-intensity, warning light (Type B) provides a flashing yellow light in one direction only, for use both day and night. These lights can be mounted on traffic signs, or barricades to warn road users. These warning lights must be in accordance with current Institute of Transportation Engineers (ITE) "Purchase Specification for Flashing and Steady-Burn Warning Lights."





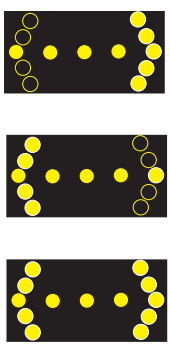
Instructions for Use: At work areas where the placement of the advance warning sign at the standard distances is not practical, or is found to be ineffective, and the advance-warning sign with flag tree is also found to be ineffective, the

advance-warning flasher may be used in conjunction with the advance-warning sign to provide additional warning to oncoming traffic. When mounted on an advance-warning sign, the distance from the roadway to the bottom of the lens of the light must not be less than 8 feet.

Note: The flag tree can be used in conjunction with the advance-warning sign during daylight hours and/or the advance-warning flasher during hours of darkness.

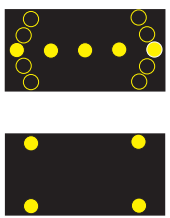
Flashing-Arrow Panel

Description: The unit must consist of a black rectangular background at least 4 feet wide and 2 feet high, with yellow flashing lights at least 4 inches in diameter, which form a clearly recognizable arrow symbol.



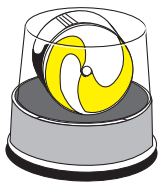
Instructions for Use: The unit may be mounted at a height of at least 7 feet from the bottom of the unit on a trailer or other suitable support. Vehicle-mounted panels should be as high as practicable. This sign can provide additional warning and directional information to assist in merging and controlling traffic around the work area.

If using an arrow panel, the arrow or chevron mode must be used for lane closures on multi-lane streets. If more than one lane is closed, a separate arrow panel must be used for each closed lane. The caution mode must be used in situations where one lane of a two-way street is closed. The caution mode may also be used for work (including surveying) done on shoulders and sidewalks near traffic situations.



Note: Arrow panels may be used in conjunction with warning signs. They may not be used to replace warning signs.

Hazard-Vehicle Light



Description: Vehicle-mounted, revolving (360 degrees) amber light.

Instructions for Use: The light must be displayed and be visible to all approaching traffic when the vehicle is operated at a work site in the roadway and the vehicle is not within a protected work area.

Work Area Protection

Work area protection involves the immediate area in which workers' activities are taking place. Consideration must be given to pedestrian and motorist protection. The work area is generally bordered by:

- Stanchions with telescoping rails and/or orange barrier tape, and/or
- Barricades Type I, Type II, or Type III.

Traffic-control devices, including channelizing devices, such as stanchions and cones, as well as sign supports and barricades, must conform to new requirements set by the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance of Highway Features," and are to be constructed of crashworthy materials.

Protection of Pedestrians

Traffic-control devices used to delineate pedestrian walkways must be crashworthy so that if struck by a vehicle, there will be a minimal threat to pedestrians, workers, and the occupants of vehicles.

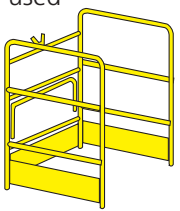
When existing pedestrian paths are disrupted or closed, alternate routes must be provided to crosswalks and bus stops. Signage may be provided to improve recognition of a temporary pedestrian route.

Stanchions with telescoping rails are to be used to channel pedestrians safely around the work area. Such barricades should be detectable to users of canes with a bottom rail no higher than 2 inches above ground, and a top rail at least 32 inches above ground.

If storing materials outside of the work area setup near pedestrian pathways (sidewalks and crossings), Type III barricades should be used to channel pedestrians safely around these storage areas.

Note: The devices must form a continuous barrier without any gaps between the devices.

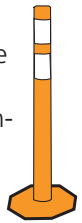
Subsurface Protection Devices



Description: Manhole guardrail and telescoping rails are used to prevent personnel, debris, tools and pedestrians from falling into subsurface structures and are not a traffic-control device. Manhole guardrails are yellow and equipped with three sides and two rails, plus a toe-board. The height of the top rail must not be less than 42 inches. Telescoping rails are mounted onto stanchions. The first rail is placed at the bottom of the stanchions and the second rail is secured at the top.

Instructions for Use: Manhole guardrails are to be used for open manholes. Manhole guardrails must be used for the following subsurface type of structure opening with type of covers: service valve castings, SI, S2, S3, 32-inch manhole cover, and 44-inch manhole cover. Larger subsurface structures require type 2 barricades.

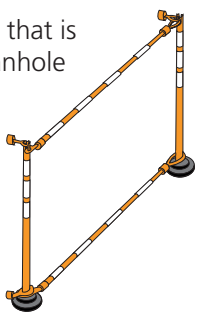
Stanchions, Telescoping Rails, and Boundary Tape





Description: Stanchions must be crashworthy*, must consist of orange uprights at least 42 inches high with bases, and may be of a tubular or cone style. Each must have a minimum of two retroreflector bands near the top of the stanchion. The boundary tape is orange.

Instructions for Use: To outline the boundaries of street work areas such as:



- An open manhole that is protected by a manhole guardrail;
- Vault cage entry;
- Overhead pole work;
- Setup around Vactor/flush trucks.

* Temporary Traffic-Control (TTC) devices used to delineate a TTC zone pedestrian walkway must be crashworthy and, when struck by vehicles, present a minimum threat to pedestrians, workers, and occupants of impacting vehicles.

Barricades

Description: Barricades must be crashworthy and are of three types:

Type I – Has one rail that must be a minimum length of 2 feet and a width of 8 inches to 12 inches. Minimum height requirement is 36 inches.

Type II – Has two rails that must each be a minimum length of 2 feet and a width of 8 inches to 12 inches.

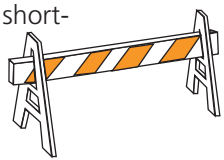
Type III – Has three rails that must each be a minimum length of 4 feet and a width of 8 inches to 12 inches. Minimum height requirement is 60 inches.

In addition, for all types:

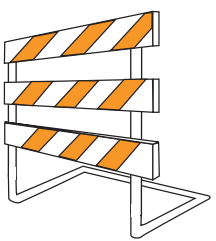
- Rails must be marked with alternate orange and white stripes at an angle of 45 degrees.
- Rails must be retroreflective for night use. And 270 square inches for freeways.

Instructions for Use: Barricades are used to mark an obstruction (work area) in the roadway and are required to outline excavations.

- The Type I barricade is used for temporary or short-duration work and for out lining excavations.



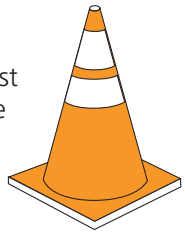
- The Type III barricade is normally used to face oncoming traffic for long-duration work where the barricade is to remain in the roadway for extended periods.



- Telescoping rails with stanchions are to be used to channel pedestrians safely around the work area. Type II or Type III barricades may be used at pedestrian crossings, as well as at sidewalks or other areas where pedestrians would normally come into contact with the work area.
- Ballasts must not be placed on the top rail and must not consist of nondeformable objects such as rocks or concrete.

Note: The addition of company identification must not detract from the striping on the face of the barricade rail(s) facing oncoming traffic.

Cones



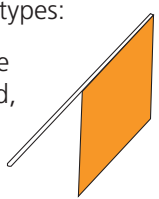
Description: Cones must be orange and must be between 28 and 36 inches in height with two reflectorized bands near the top. For nighttime use, cones must be retroreflectorized or equipped with lighting devices for maximum visibility. Retroreflectorization of cones that are 28 to 36 inches in height must be provided by a 6-inch-wide white band located 3 to 4 inches from the top of the cone and an additional 4-inch-wide white band located approximately 2 inches below the 6-inch-wide band.

Instructions for Use: The primary function of cones is to channel traffic. The cone should be used to control and direct traffic around or through the work area by gradually narrowing the roadway and indicating the path to be followed. Cones may be used in combination with:

- A flag inserted in the top of the cone to enhance its target value during daylight hours;
- Type B warning lights (high-intensity flashers), which may be used day or night (warning lights must flash when used to warn of a condition);
- Type C steady-burn warning lights when used to channelize traffic.

Signaling Devices

Description: Signaling devices must be one of the following types:



- Signal flag – must be retroreflectorized red, at least 24 inches by 24 inches, securely fastened to a staff 36 inches long.



- Signal light – a steadily burning red or red-orange flashlight wand.

- Paddle – a combination "Stop" and "Slow" sign on an octagonal panel, at least 18 inches wide with letters 6 inches high, securely fastened to a rigid handle. Both faces must be retroreflectorized for nighttime use. The "Stop" face must be red with white letters and border. The "Slow" face must be orange with black letters and border.

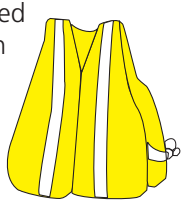


Instructions for Use: Signaling devices should be used by flaggers to issue signals to oncoming traffic.

- The signal flag is for use during daylight hours, and the signal light is for use during emergency situations by a single flagger.
- The "Stop" and "Slow" paddles are used day or night when more guidance to motorists is needed. However, they should not be used where display of the paddle face in the opposite direction would be inappropriate or misleading.
- Use of the "Stop" and "Slow" paddle is preferable in a two-way traffic condition, such as the middle of a street, as opposed to an intersection where traffic may travel in four directions.

Safety Apparel

Description: Flaggers, as well as employees outside of the work area setup, must wear approved safety apparel available in Class & Stock.



Note: Must be used in work where mobile equipment is used or machinery is moving

Instructions for Use: Vests or compliant apparel must be worn on the outside of all other clothing. Trained employees assigned as flaggers must wear safely apparel when controlling traffic. When leaving or working outside a protected work area, employees exposed to vehicle traffic, e.g., setting up, maintaining, or removing work area protection, must wear a safety vest. Surveyors and employees working in the roadway with minimum protection must wear a safety vest.

Remember: The value of your safety vest is diminished when you crouch, bend, or move into a position that reduces your visibility or the reflective value of the vest.

Flags (used in conjunction with traffic-control devices)

Description: Flags must be orange; a minimum of 16 inches by 16 inches and attached to a staff at least 30 inches long.

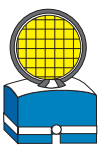


Instructions for Use: Flags may be displayed in a manner that does not obscure the legend above any channeling device, on vehicles or tool carts, on stanchions and barricades, and above warning signs.

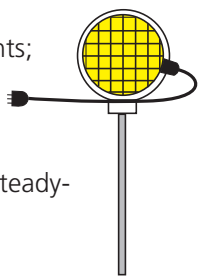
Note: Flags are a supplement to increase the target value and visibility of the work area during daylight hours. Flags may be placed at suitable intervals of not more than 20 feet during daylight hours on barricades used to outline excavations.

Low-Intensity Warning Lights

Description: Low-intensity lighting is for use during nighttime hours only. All warning lights must comply with the ITE "Purchase Specification for Flashing and Steady-Burn Warning Lights," such as:

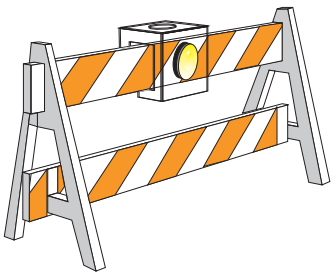


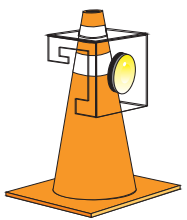
- Type A low-intensity flashing warning lights;
- Type C steady-burn warning lights;
- Type D 360-degree steady-burn warning lights.

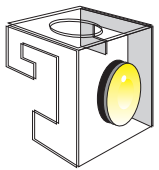


Instructions for Use: On barricades used to outline excavations, one light must be placed on the barricades at suitable intervals of not more than 20 feet. Use during hours of darkness only. (Use Type B high-intensity flashing warning lights for day and night.) Warning lights must have a minimum mounting height of 30 inches.

Safety cones/barricade LED lights







Traffic Control and Work Area Protection Arrangements

3

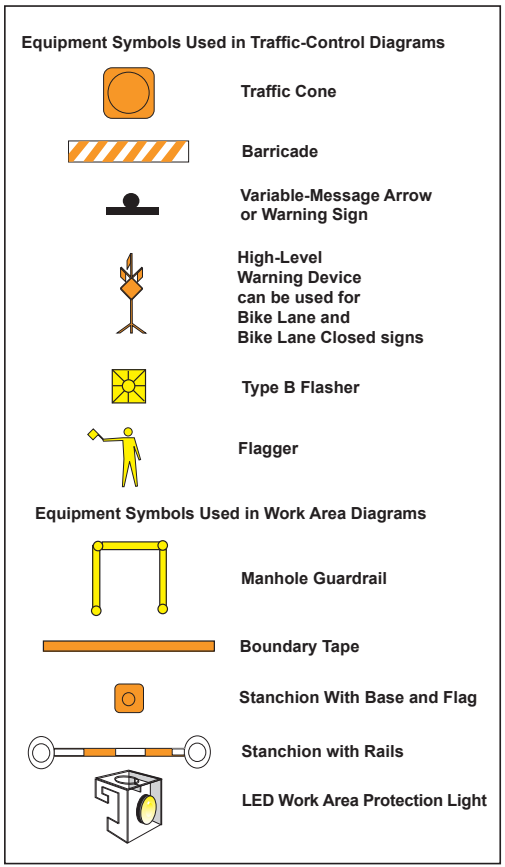
Work Area Protection Diagrams

This section provides graphic diagrams showing a variety of typical work locations. In each case, a scene is provided showing the work area protection properly deployed. In addition, a smaller "blueprint" diagram providing an overhead view of the job site helps to clarify the placement of signage, lights, barriers, and other work area protection equipment.

The arrangements shown in this section do not cover every possible work area configuration. They are intended to provide a representative sample of field conditions and to offer guidance when planning work area protection in similar settings. If you're not sure how to proceed, talk to your supervisor.

Using these diagrams as reference, you must also:

1. *Review the DOT permit for conditions of work. Verify information if needed.*
2. Select a traffic-control diagram that meets most nearly the requirements to control traffic at the work site.
3. Select a work area protection diagram for your type of operation.
4. Set up the work site in accordance with the arrangements selected. Adapt the arrangements where necessary to meet local conditions.



Work Area Protection Diagrams

These configurations are generally applicable to comparable work areas with similar road conditions.

- Setup for Pole Setting on Four-Lane Road With Two Lanes of Traffic in Each Direction
- Setup for Curved Two-Lane Road With Two-Way Traffic
- Setup in Middle Lane of Three Lanes of Traffic Moving in the Same Direction
- Setup in One Lane of a Four-Lane Road With Two Lanes of Traffic in Each Direction
- Setup at an Intersection With Pedestrian Crosswalks
- Setup at an Intersection With Pedestrian Crosswalks
- Setup Around Subsurface structure in Sidewalk Area
- Setup in Middle of Roadway Diverting Traffic
- Setup in Street Blocking Bike Lane

Setup for Pole Setting on Four-Lane Road With Two Lanes of Traffic in Each Direction

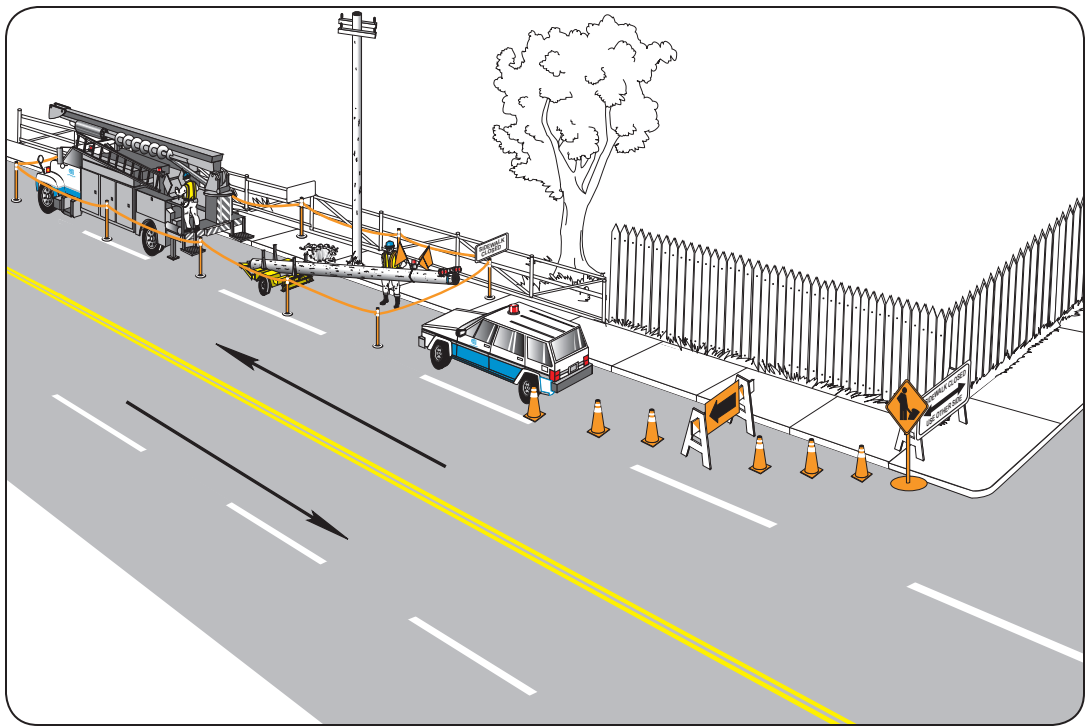
This configuration is generally applicable to comparable work areas with similar road conditions.

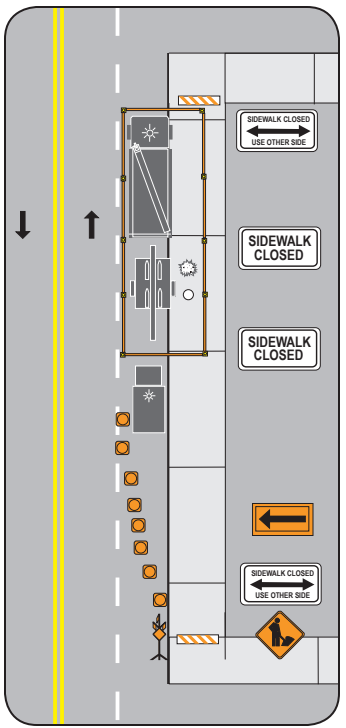
Setup

- Where necessary, assign a flagger while the work area is being prepared.
- Place the advance-warning sign at the beginning of the tapered work zone.
- Place the "Lane Closed" sign to appear in plain view after the advance-warning sign for traffic traveling toward the one closed lane.
- Place traffic cones so that the traffic is tapered away from the work area.
- Set up stanchions and boundary tape. (Tape may be used when pedestrians have restricted access to the work area.)
- Post "Sidewalk Closed" sign near setup (optional).
- Post "Sidewalk Closed — Use Other Side" sign on both sides of the work area, at the nearest corners to restrict pedestrian traffic on the work side of the street.

Equipment

- Advance-warning sign ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- 28" or 36" traffic cones
- Lane-closure sign (arrow board or flashing-arrow panel)
- Stanchions and boundary tape
- Sidewalk-closed signage





Blueprint of work area

Setup for Bucket Truck on Curved Two-Lane Road With Two-Way Traffic

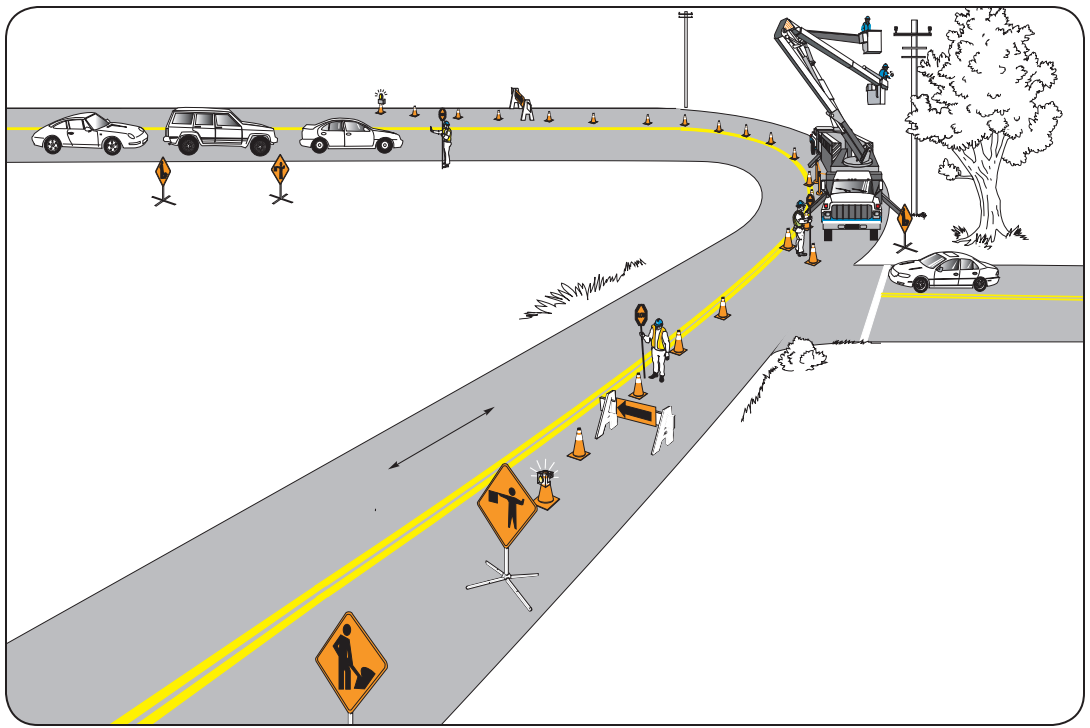
This configuration is generally applicable to comparable work areas with similar road conditions.

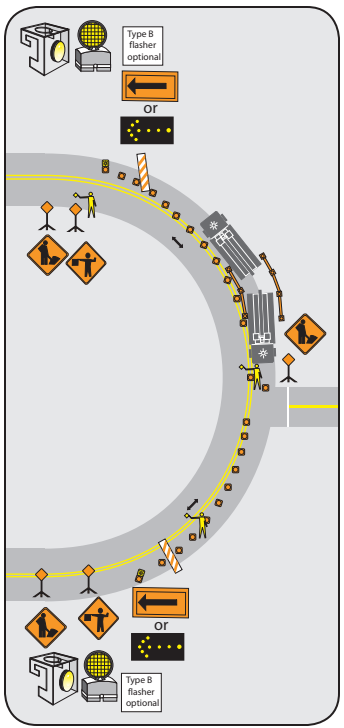
Setup

- Assign three flaggers, one at each end of the work area, and one at a nearby intersection, to control the flow of two-way traffic in one lane. The flagger position should be within a protected area, such as the tapered area.
- Ensure communications among flaggers (walkie-talkies).
- Place the advance-warning sign at the beginning of the tapered work zone for both sides of oncoming traffic.
- Place "Flagger Ahead" signs after the advance-warning sign and well before the flagger position.
- Place the "Lane Closed" sign to appear in plain view after the advanced warning sign for traffic traveling toward the one closed lane.
- Place the "Lane Closed" sign for traffic approaching on the opposite side of the double yellow line (optional).
- Place traffic cones so that upstream and downstream traffic are both tapered away from the work area.
- Set up stanchions and boundary tape to extend around work areas (tape may be used when pedestrians have restricted access to the work area).

Equipment

- 3 advance-warning signs ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- Flags (optional)
- 2 lane-closure signs (arrow board or flashing-arrow panel)
- 2 "Flagger Ahead" signs
- 28" or 36" traffic cones
- Stanchions and boundary tape, safety cone, barricade LED lights
- Type B flashers (optional)
- 3 sets of flagger-communication equipment
- 3 flagger paddles





Blueprint of work area

Setup for Excavation in Middle Lane of Three Lanes of Traffic Moving in the Same Direction

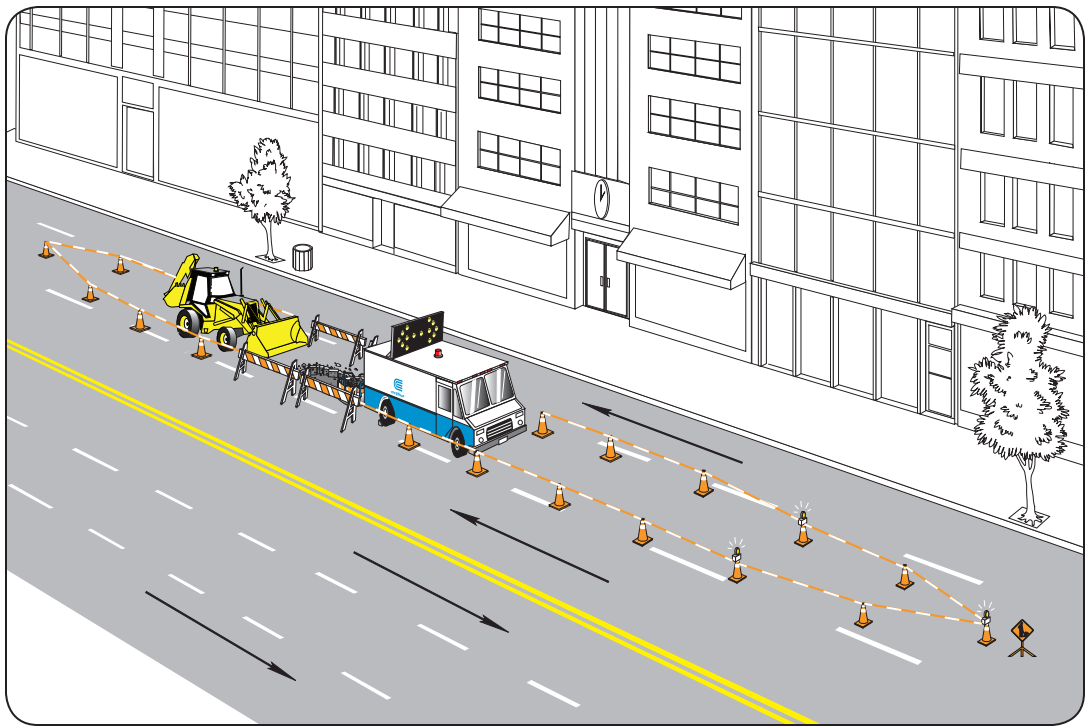
This configuration is generally applicable to comparable work areas with similar road conditions.

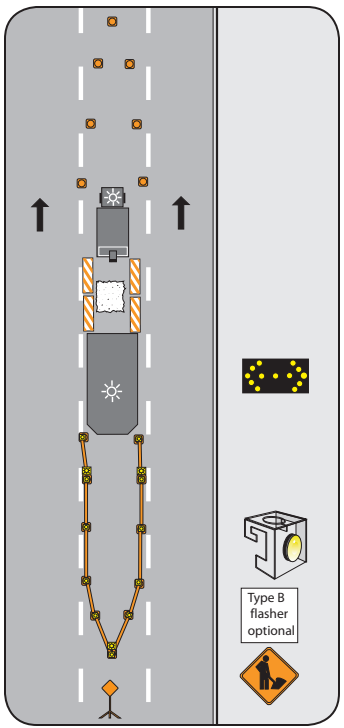
Setup

- Where necessary, assign a flagger while the work area is being prepared.
- Place the advance-warning sign at the beginning of the tapered work zone.
- Place the "Lane Closed" sign in plain view after the advance-warning sign.
- Place traffic cones so that the traffic is tapered away from the work area.
- Place sturdy barricades around the excavation work area.
- Filled Pel bags should be placed inside the work area nearest barricades that are most at risk of impact from oncoming traffic.

Equipment

- Advance-warning sign ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- Flags (optional)
- 28" or 36" traffic cones
- Lane-closure sign (arrow board or flashing-arrow panel)
- Type B flashers/LED lights (optional)
- Stanchion and telescoping rails
- Barricades





Blueprint of work area

Setup for Flush Truck in One Lane of a Four-Lane Road With Two Lanes of Traffic in Each Direction

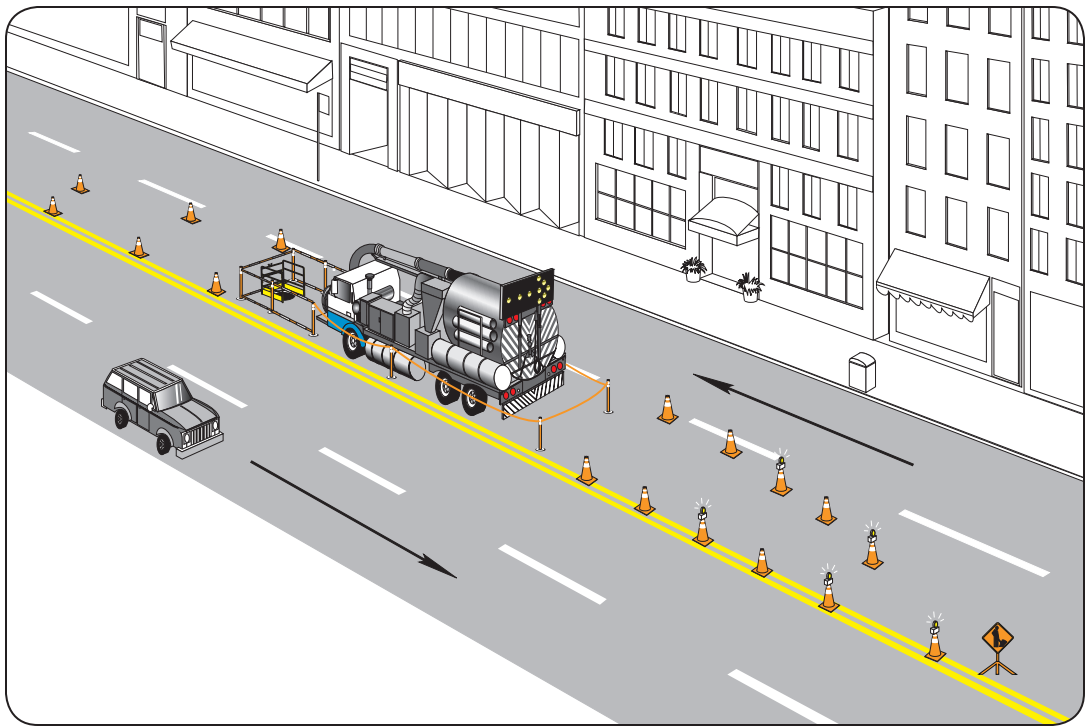
This configuration is generally applicable to comparable work areas with similar road conditions.

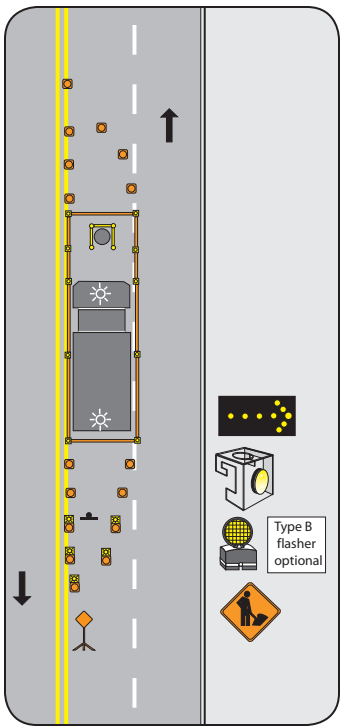
Setup

- Where necessary, assign a flagger while the work area is being prepared.
- Place the advance-warning sign at the beginning of the tapered work zone for both sides of oncoming traffic.
- Place the "Lane Closed" sign to appear in plain view after the advance-warning sign for traffic traveling toward the one closed lane.
- Place the flashing-arrow panel, in the caution mode (no arrow) for traffic approaching on the opposite side of the double yellow line (optional).
- Place traffic cones so that the oncoming traffic is tapered away from the work area.
- Place traffic cones to ease the downstream traffic flow and maintain separation of traffic flowing in the opposite direction.
- Set up stanchions and boundary tape to extend completely around the flush operation. (Tape may be used when pedestrians have restricted access to the work area.)

Equipment

- Advance-warning sign ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- Flags (optional)
- 28" or 36" traffic cones
- Lane-closure sign (arrow board or flashing-arrow panel)
- Flashing-arrow panel, in the caution mode (optional)
- Stanchions, telescoping rails, and boundary tape
- Type B flashers (optional)
- Manhole guardrail





Blueprint of work area

Setup for Tool Cart at an Intersection With Pedestrian Crosswalks

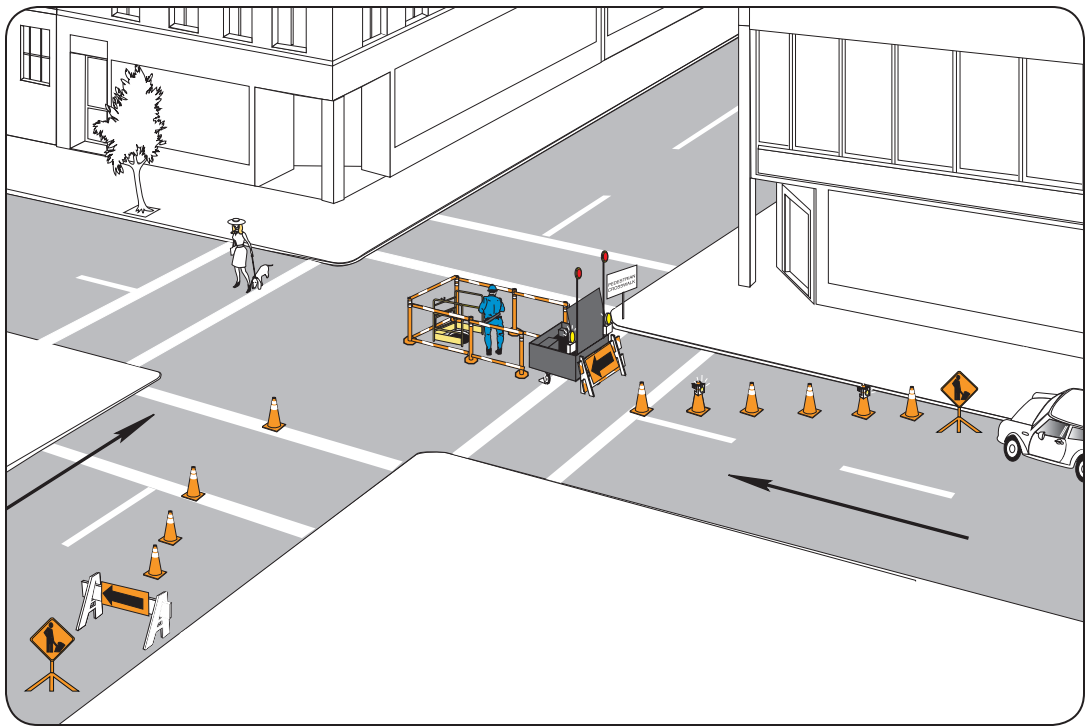
This configuration is generally applicable to comparable work areas with similar road conditions.

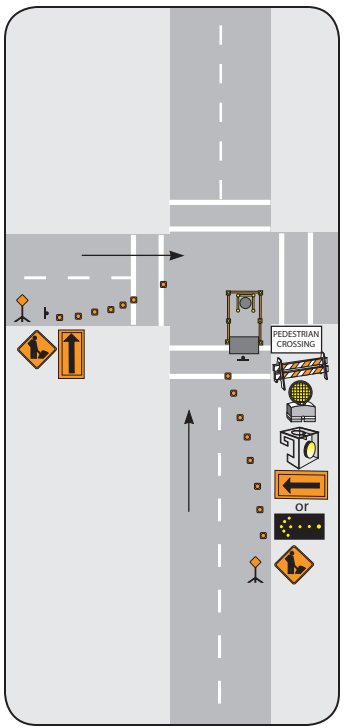
Setup

- Where necessary, assign a flagger while the work area is being prepared.
- This work area is immediately preceded by a parking lane. Place one advance-warning sign in the parking lane and another advance-warning sign for traffic that is restricted to the left of the work area.
- Place the "Lane Closed" sign so that it appears in plain view after the advance-warning sign for traffic that is restricted to the left of the work area. ("Lane Closed" signs are not required for parking lanes.)
- Place traffic cones so that the traffic is tapered away from the work area for oncoming traffic. Maintain pedestrian access to crossings not affected by the work area.
- Maintain pedestrian safety from upstream traffic at all relocated crossings with placement of Type III barricades or with barricades equipped with a bottom rail at most 6 inches above street level and a top rail at least 36 inches high (see Protection of Pedestrians, page 17).
- Place Type B flashers on barricades at pedestrian crossings.
- Post the "Pedestrian Crossing" sign to redirect pedestrian traffic.
- Set up stanchions and boundary tape to extend around work areas. (Tape may be used when pedestrians have restricted access to the work area.)

Equipment

- 2 advance-warning signs ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- 28" or 36" traffic cones
- 1 lane-closure sign (arrow board or flashing-arrow panel)
- Type III barricades or barricades equipped with two rails
- Stanchions, telescoping rails
- 2 to 4 Type B flashers (required)
- "Pedestrian Crossing" sign (optional)
- LED work area protection lights (optional)
- Manhole guardrail





Blueprint of work area

Setup for Cable Trucks at an Intersection With Pedestrian Crosswalks

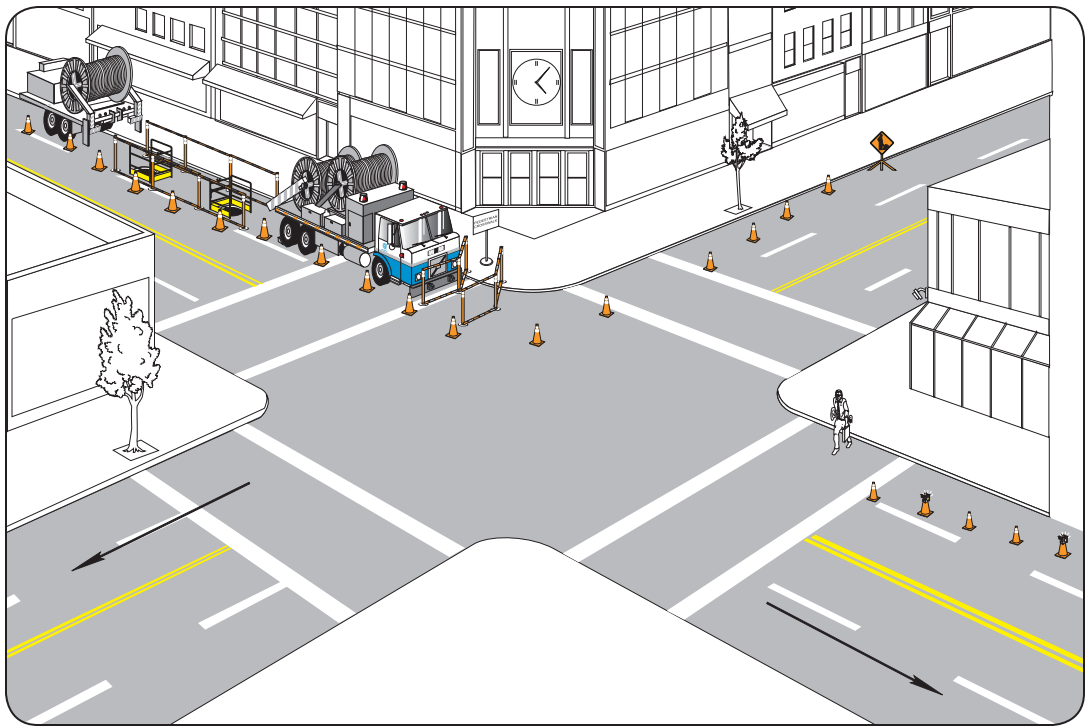
This configuration is generally applicable to comparable work areas with similar road conditions.

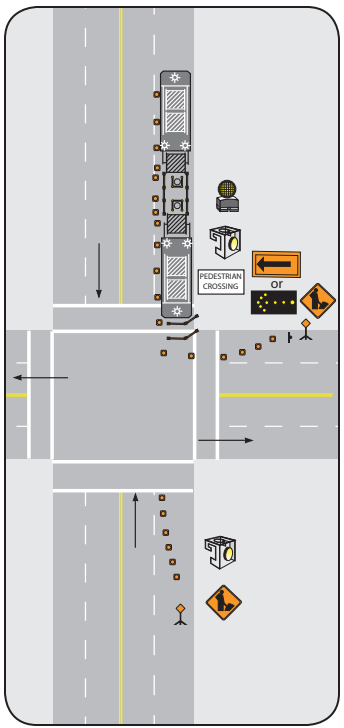
Setup

- Where necessary, assign a flagger while the work area is being prepared.
- Place the advance-warning signs on the far side of the intersection for traffic traveling upstream and for traffic that is restricted from turning into that lane.
- Place the "Lane Closed" sign to appear in plain view after the advance-warning sign for traffic traveling toward the one closed lane.
- Place traffic cones so that the traffic is tapered away from the work area for oncoming traffic.
- Maintain pedestrian access to crossings not affected by the work area.
- Maintain pedestrian safety from upstream traffic at all relocated crossings with placement of Type III barricades or with barricades equipped with a bottom rail at most 6 inches above street level and a top rail at least 36 inches high (see Protection of Pedestrians, page 17).
- Place Type B flashers on barricades at pedestrian crossings.
- Post the "Pedestrian Crossing" sign to redirect pedestrian traffic.
- Set up stanchions and boundary tape to extend around work areas. (Tape may be used when pedestrians have restricted access to the work area.)

Equipment

- 2 advance warning signs ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- Flags (optional)
- 28" or 36" traffic cones
- 2 lane-closure signs (arrow board or flashing-arrow panel)
- Type III barricades or barricades equipped with two rails
- Stanchions and telescoping rails
- 2 to 4 Type B flashers (required)
- "Pedestrian Crossing" sign (optional)
- Manhole guardrails





Blueprint of work area

Job setup on sidewalk

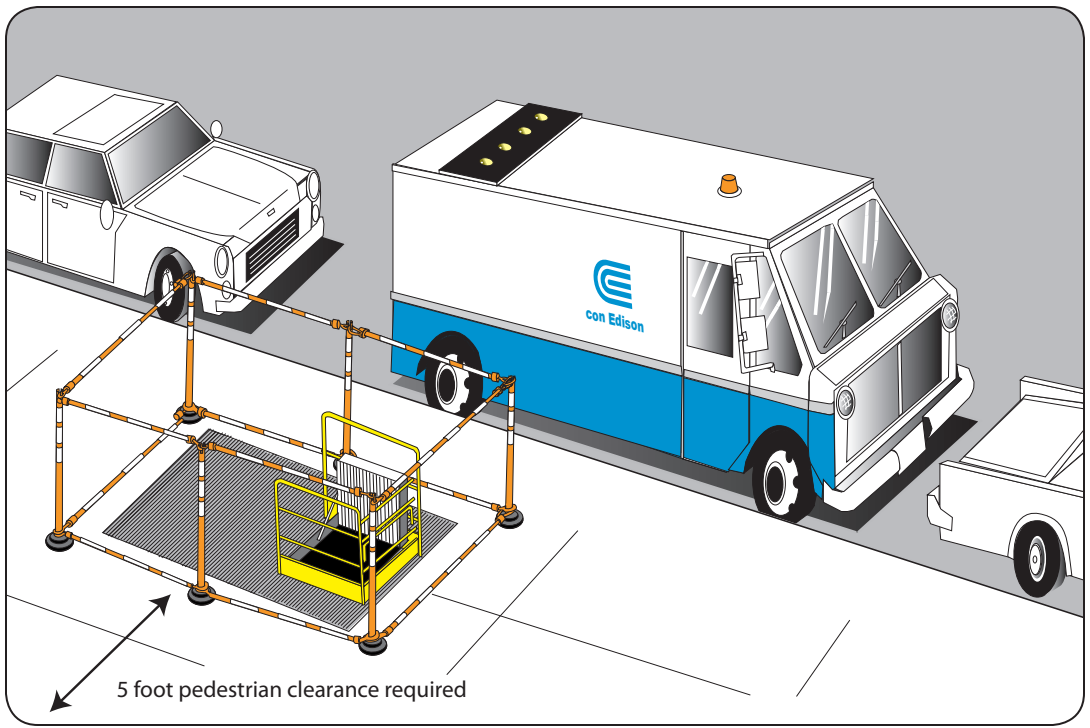
This configuration is generally applicable to comparable work areas with similar sidewalk conditions.

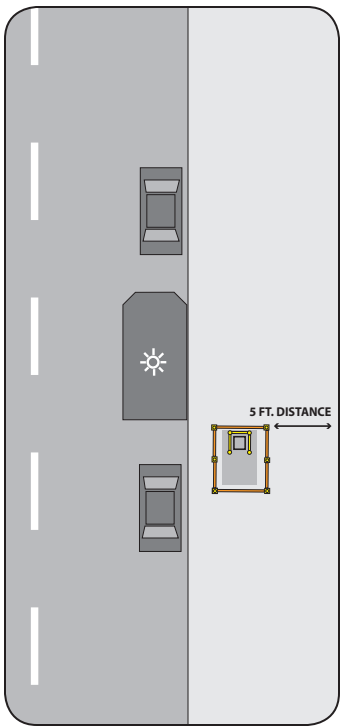
Setup

- Secure area with telescoping rail/stanchion combination.
- Two telescoping rails must be used per section, one on the bottom and the other hung on the top of the stanchions.
- Place cones around setup to give advance warning to pedestrians.
- Open underground structure covers.
- Utilize manhole guardrails, when feasible.

Equipment

- Stanchions and telescoping rails
- Manhole guardrail





Blueprint of work area

Closure/redirection of bike lane

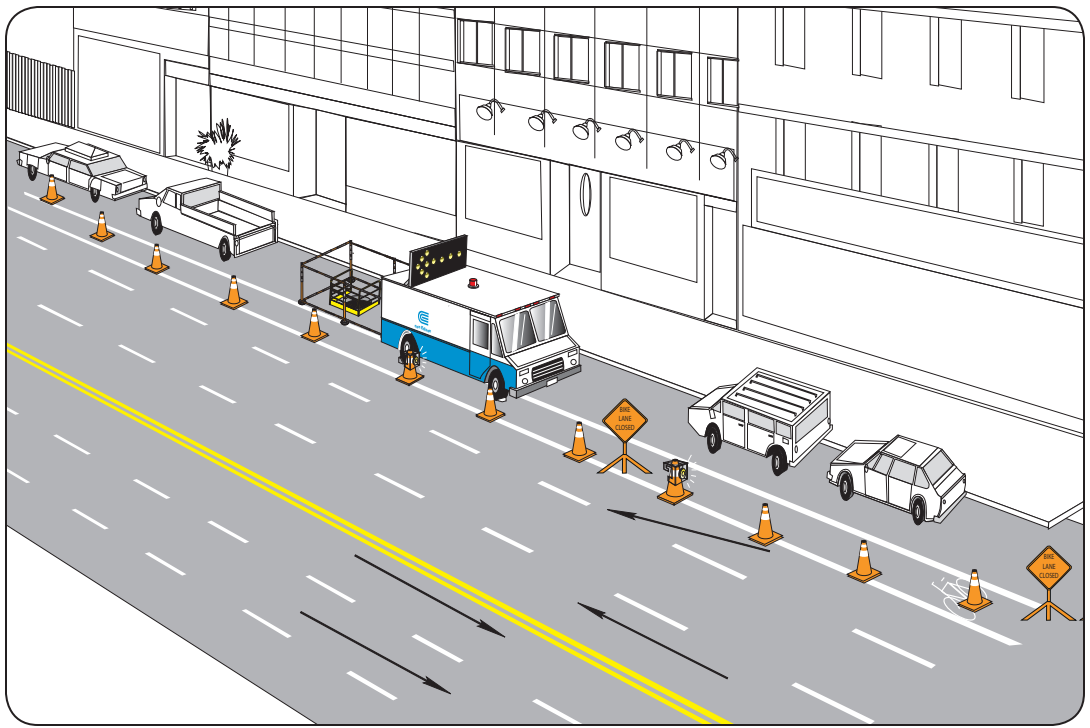
This configuration is generally applicable to comparable work areas with similar road conditions.

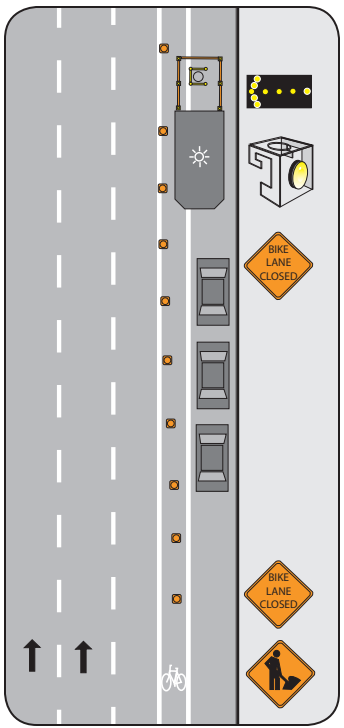
Setup

- Assign two flaggers while the work area is being prepared.
- Place the advance-warning signs on the far side of the intersection for traffic traveling upstream and for traffic that is restricted from turning into that lane.
- Place the "Bike Lane Closed" advance warning sign 350 feet and 200 feet prior to work zone, and also post at work zone.
- Place traffic cones so that the traffic is tapered away from the work area for oncoming traffic, while maintaining the bike lane.
- Maintain pedestrian access to crossings not affected by the work area.
- Set up stanchions with telescoping rails to extend around work areas. (Tape may be used when pedestrians have restricted access to the work area.)

Equipment

- Advance-warning signs ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- Bike lane closed sign
- Flags (optional)
- 28" or 36" traffic cones
- 2 lane-closure signs (arrow board or flashing-arrow panel)
- Stanchions and telescoping rails
- Manhole guardrail and telescoping rails





Blueprint of work area

Diverting traffic into an oncoming lane

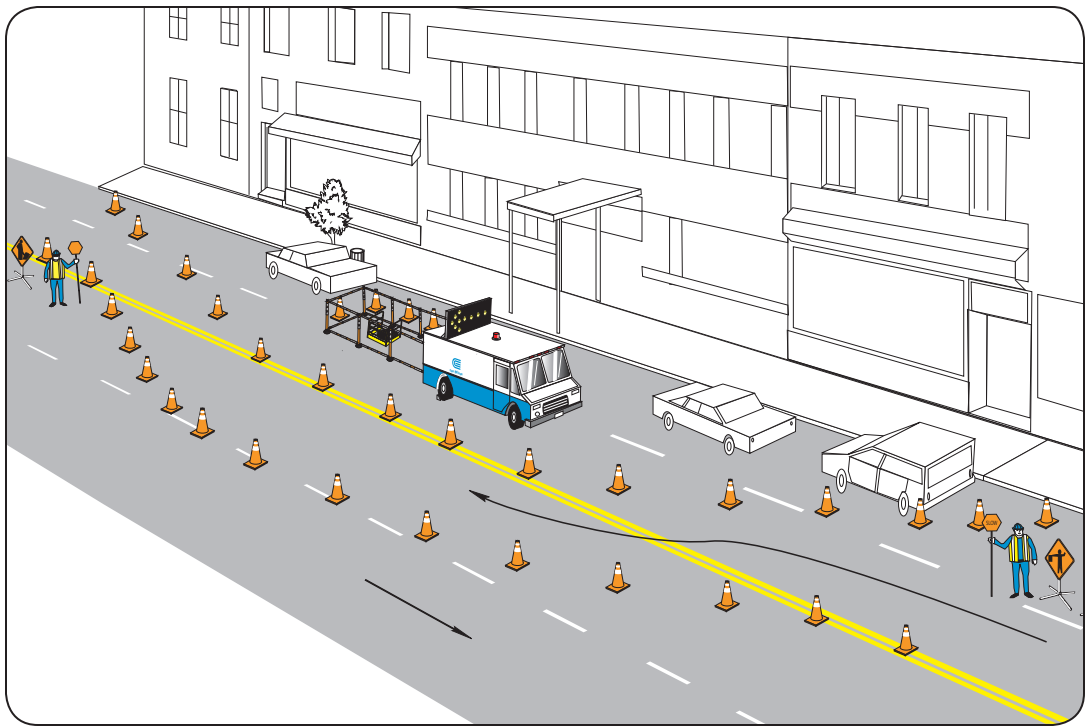
This configuration is generally applicable to comparable work areas with similar road conditions.

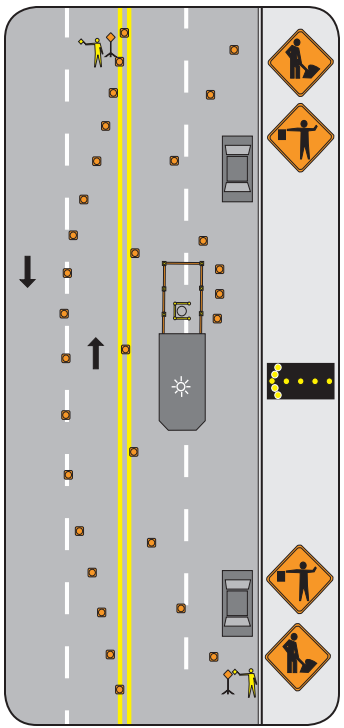
Setup

- Assign two flaggers while the work area is being prepared.
- Place the advance-warning sign at the beginning of both ends of the tapered work zone for both sides of oncoming traffic.
- Place the "Lane Closed" sign to appear in plain view after the advance-warning signs for traffic traveling toward the one closed lane.
- Place the flashing-arrow panel for traffic approaching on both sides of the double yellow line, directing the the traffic away from the work area.
- Place traffic cones so that the oncoming traffic is tapered away from the work area.
- Place traffic cones to ease the downstream traffic flow and maintain separation of traffic flowing in the opposite direction.
- Set up stanchions with telescoping rails around work set up behind the vehicle.

Equipment

- 2 advance-warning signs ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- Flags (optional)
- 28" or 36" traffic cones
- 2 lane-closure signs (arrow board or flashing-arrow panel), whichmust direct traffic coming from both directions
- Stanchions and telescoping rails around work area
- Manhole guardrail





Blueprint of work area

Setup for Excavations in Sidewalk Area Re-directing Pedestrian Traffic

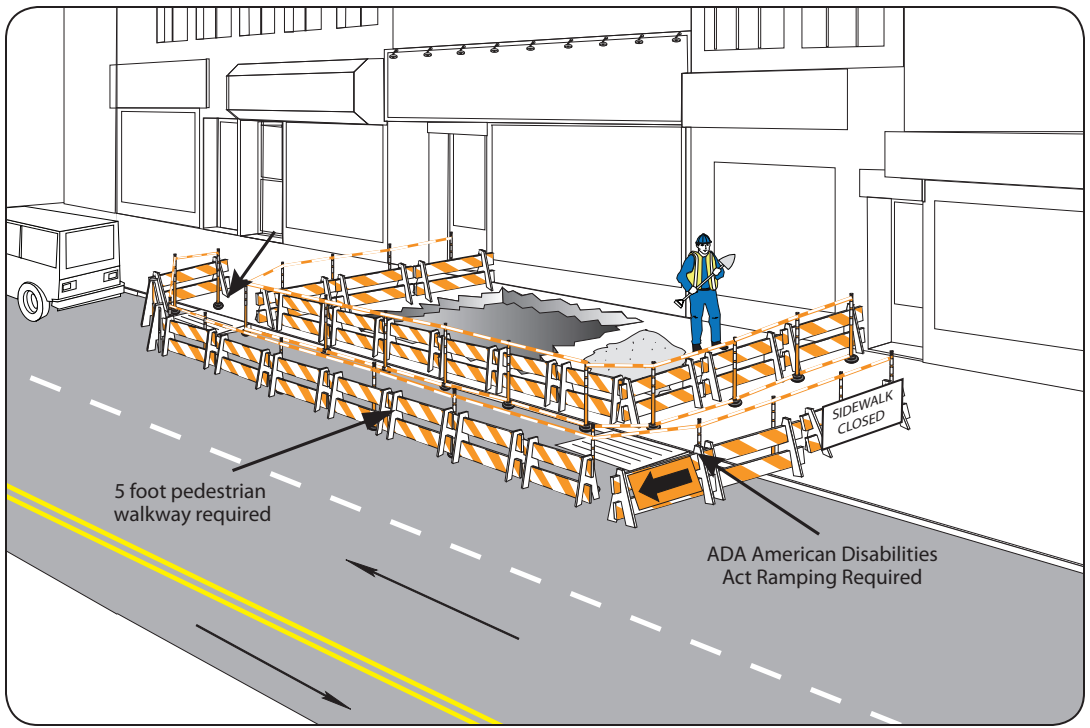
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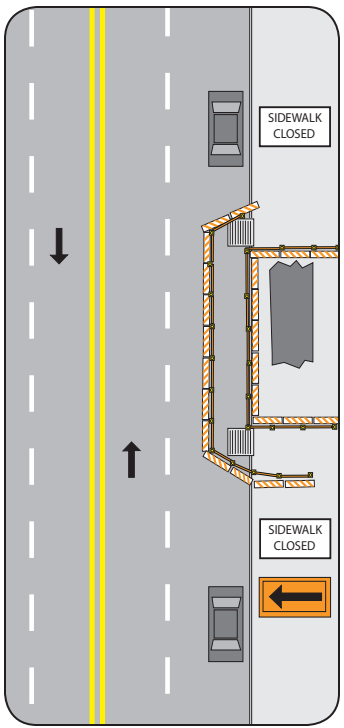
Setup

- Where necessary, assign a flagger while the work area is being prepared.
- Place sturdy barricades around the excavation work area.
- Place stanchions with telescoping rails to channel pedestrians around work area.
- Install ramps at curb entrance and exit of pedestrain passageway.
- Filled Pel bags should be placed in work area.
- Post "Sidewalk Closed" sign near setup.
- Post "Sidewalk Closed Use Other Side" sign on both sides of work area, at the nearest corners, to restrict pedestrian traffic on the work side of the street.

Equipment

- Type III barricades or barricades equipped with 2 rails
- Stanchions with telescoping rails
- Directional-arrow signs
- Sidewalk closed signs
- Ramps





Blueprint of work area

Setup for Excavation Near Curbside in Vehicle Parking Lanes

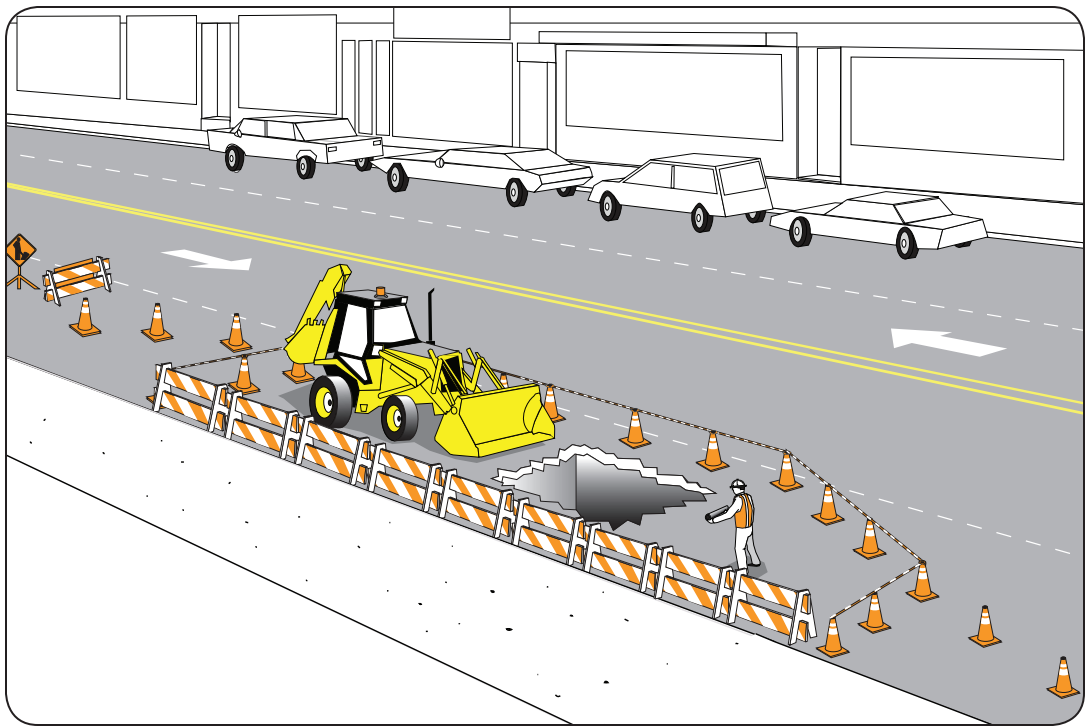
This configuration is generally applicable to comparable work areas with similar road conditions.

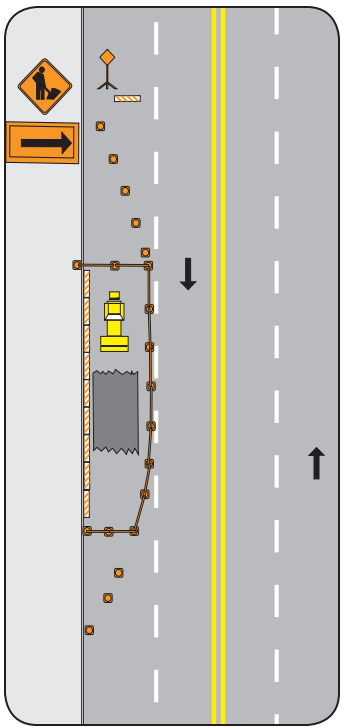
Setup

- Place sturdy barricades around the excavation work area.
- Cones with telescoping rails may be used around work area closed to vehicle traffic (optional).
- Lane-closure sign (arrow board or flashing-arrow panel).
- Type B flashers (optional).
- Advance–warning sign at the beginning of the tapered work zone.
- Filled Pel bags should be placed inside the work area nearest barricades that are most at risk of impact from oncoming traffic.

Equipment

- Type III barricades or barricades equipped with 2 rails
- Directional-arrow signs
- 28"-36" traffic cones
- Advance–warning sign
- Telescoping rails





Blueprint of work area

Setup for Excavations Near Intersections and Crosswalks While Redirecting Pedestrians

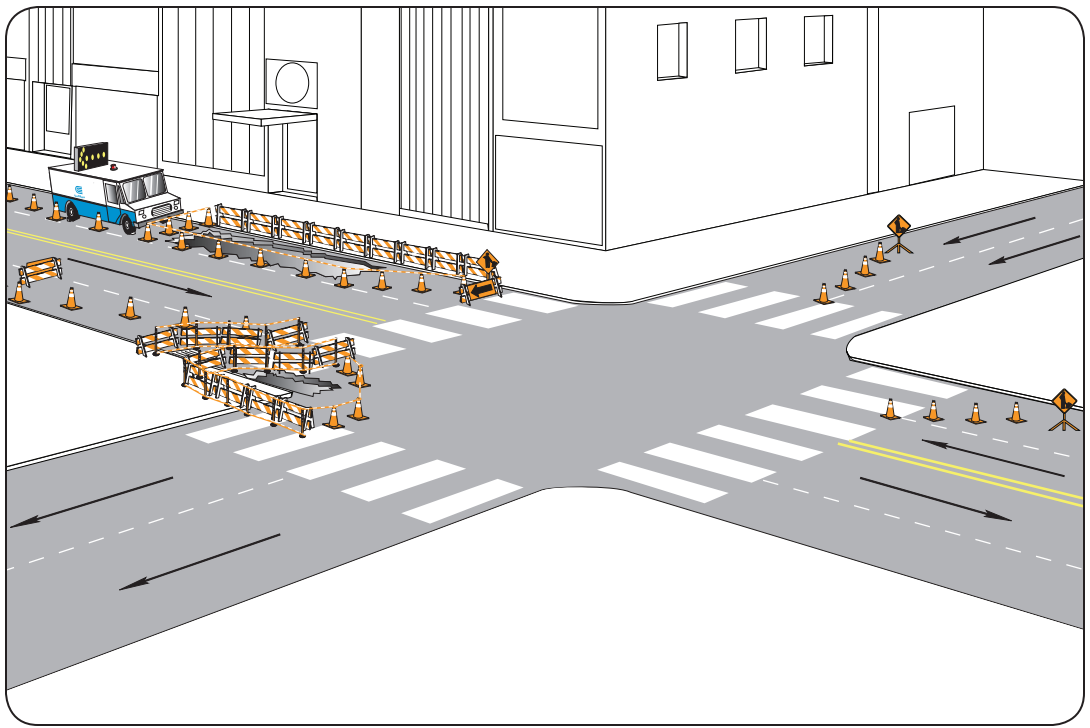
This configuration is generally applicable to comparable work areas with similar road conditions.

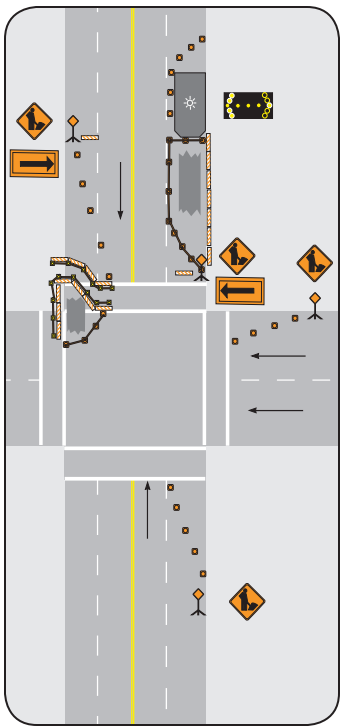
Setup

- Place sturdy type barricades around the excavation work area.
- Post the "Pedestrian Crossing" sign to redirect pedestrian traffic.
- Place Type B flashers on barricades at pedestrian crossing.
- Filled Pel bags should be placed inside the work area nearest barricades that are most at risk of impact from oncoming traffic.
- Maintain pedestrian safety from upstream traffic at all relocated crossings with placement of Type III barricades or barricades equipped with a bottom rail, no more than 6 inches above street level, and a top rail at least 36 inches high (see Protection of Pedestrians, page 17).

Equipment

- 4 advance-warning signs ("Worker Symbol," "Work Area Ahead," or "Utility Work Ahead")
- Flags (optional)
- 28" or 36" traffic cones
- 1 lane-closure sign (arrow board or flashing-arrow panel)
- Type III barricades or barricades equipped with two rails
- Stanchions, telescoping rails
- "Pedestrian Crossing" sign (optional)





Blueprint of work area

Setup for Boom Truck for Transformer Installment

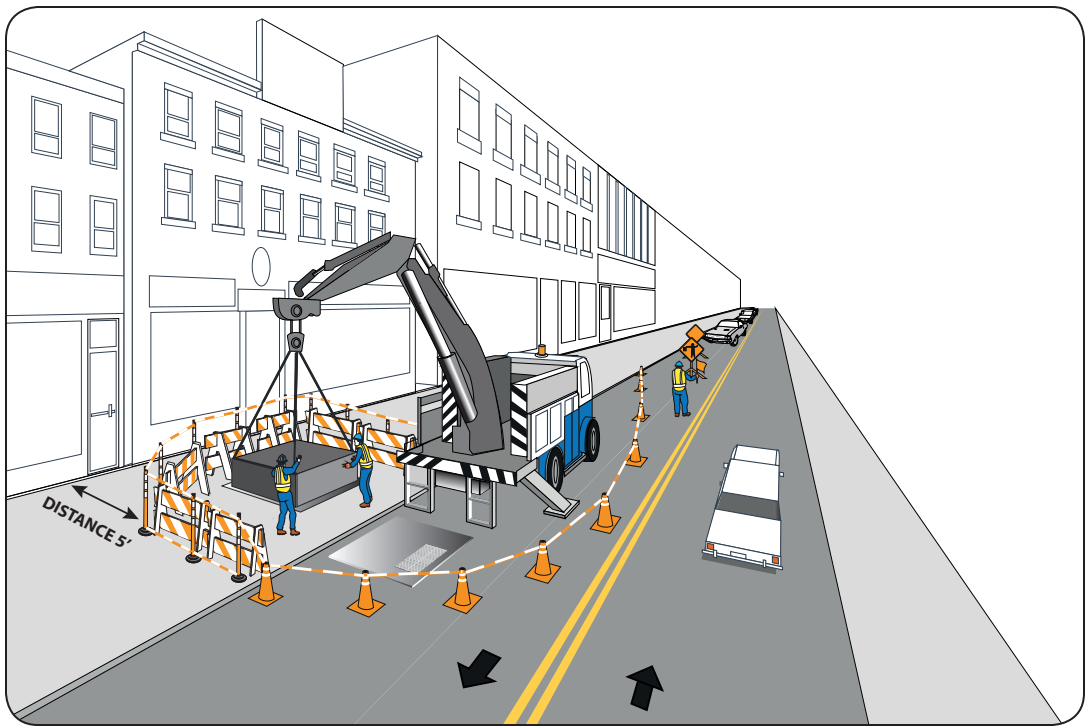
This configuration is generally applicable to comparable work areas with similar sidewalk conditions.

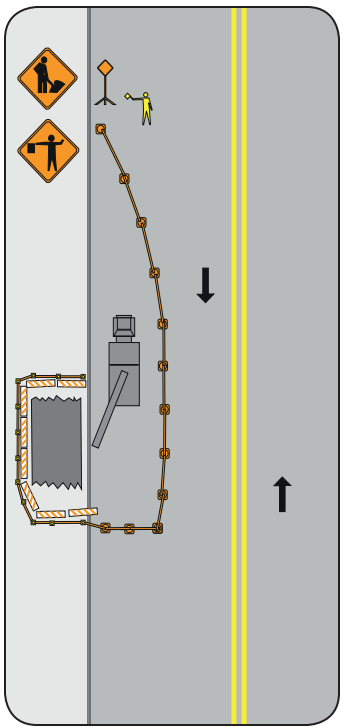
Setup

- Type 2 barricades (upper and lower rails) must be used in sidewalk area placed around the subsurface structure.
- Secure work area with cones/ telescoping rails combination in roadway.
- Install advance warning to pedestrians.
- Open underground structure covers.
- Use manhole guardrails when feasible.

Equipment

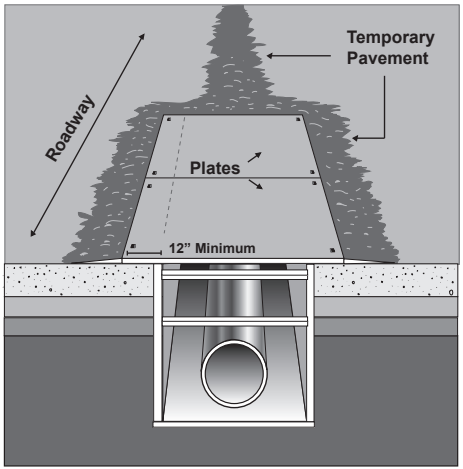
- Advance–warning sign (“Worker Symbol,” “Work Area Ahead,” or “Utility Work Ahead”)
- Flagger ahead sign
- Type 2 barricades
- 28” or 36” traffic cones
- Stanchions and telescoping rails





Blueprint of work area

Excavation Operations



Where operations require open trenches, plates should be used to maintain passageways for pedestrians and traffic lanes for vehicles.

- Plates must be large enough to span the opening, have a minimum bearing area one (1) foot wide on each side of the trench, and must be adequate to carry the load.
- Trench walls and adjacent soil must be sufficiently stable to use plates.
- Areas at the edge of plates must be tapered to provide smooth riding and safe walking conditions. ***It is important to avoid pedestrian tripping hazards or plate movement.***
- Plates must be fastened with spikes in pre-drilled holes, or spiked securely from the side to prevent movement off the openings.
- For wide trenches or unstable soil conditions, consider constructing temporary bridges.

Sign Placement During Winter Months and the Winter Moratorium

- Signs must be posted five feet prior to the steel plate(s) throughout the winter months, *regardless of weather conditions*.
- On two-way streets, signs must be posted on both sides of the street (i.e., on sidewalks) five feet prior to the steel plates.

The Winter Moratorium requires special handling of steel plates in travel lanes.

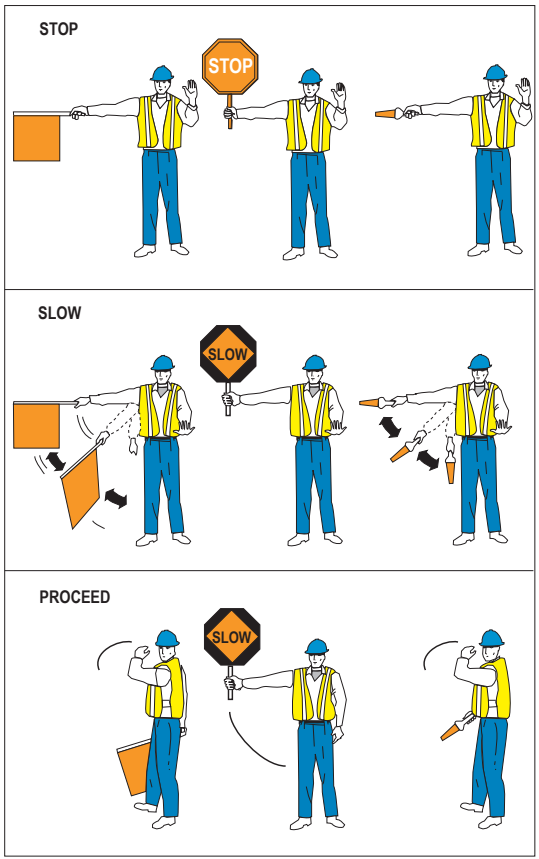
- Between December 1 and March 1, all steel plates in a travel lane must be recessed (countersunk), except if work can be completed within five working days from the permit work start date. In that case, steel plates can be pinned and ramped.
- Signs indicating Steel Plates Ahead or Raise Plow are required between December 1 and March 1, *even if steel plates are countersunk*.

Flagger at Work Sites

A flagger will be required for certain work operations where the traffic must be stopped or controlled. Flagging is a form of communication with the motorist. The language of flagging consists of only three signals: STOP, SLOW, and PROCEED.

When traffic in both directions must use a single lane for a limited distance, movements from each end must be coordinated. Provisions should be made for alternate one-way movement through the constricted section via methods such as flagger control, a flag transfer, a pilot car, traffic-control signals, or stop, or yield control. Control points at each end should be chosen to permit easy passing of opposing lanes of vehicles. If traffic on the affected one-lane roadway is not visible from one end to the other, then flagging procedures, a pilot car with a flagger, or a traffic-control signal should be used to control opposing traffic flows.

- Flaggers must wear approved safety apparel available in Class & Stock that is compliant with American National Standard for High-Visibility Apparel, ANSI 107-2010, ASTM 1506 HRC 1, Class 2 or 3 risk exposure.
- The flagger must be clearly visible at all times to approaching traffic for a distance sufficient to permit proper response by the motorist to the flagger's instructions and to permit traffic to reduce speed before entering the work zone.



- The "Flagger Ahead" sign must go before the flagger station, and the flagging station should be well ahead of the work area.
- The flagger station should be located at the start of the taper.
- The flagger should always face the oncoming traffic and make eye contact with the lead motorist.
- The flagger should stand alone, never permitting a group of workers to congregate around the flagger station.
- Flaggers will focus on the task at hand, directing traffic, and shall not be distracted by other factors, including, but not limited to, personal cell phones, electronic devices, and the like.
- When the situation requires the use of flags, only approved flags shall be used.
- When two flaggers are used, one flagger will be designated as the lead flagger.
- When two flagging stations are not visible to one another, radio communication is required or a third flagger may be stationed at a point visible in between each flagging station.
- If the flagging stations are too far apart for verbal communications, the flag transfer method of one-lane, two-way traffic control may be used. In this method, the driver of the last vehicle proceeding into the one-lane section is given a red flag and instructed to deliver it to the flagger at the other end. The opposite flagger, upon receipt of the flag, then knows that it is reasonably safe to allow traffic to move in the other direction.
- Flaggers must be illuminated at night.
- Floodlights must not produce a disabling glare condition for approaching road users, flaggers, or workers.

Stock Numbers and Descriptions

This list of stock numbers and device descriptions will help you identify the exact equipment needed to safely complete field operations.

Numbers	Description
059-6007	Chock galvanized steel
587-0894	Sign; Symbol of men working with case provided
024-7601	Sign; Bike lane ahead legend, 36" diamond shape, reflective
024-7619	Sign; Bike lane closed for work area protection
024-7429	Sign; Flagger ahead symbol, 36" diamond shape, reflective
024-7742	Sign; Lane closed ahead, 36"x36" diamond shaped
024-7510	Sign; Road closed
024-7486	Sign; Sidewalk closed
587-1298	Stand; Work area protection-advance warning
587-0491	Light; Portable compact rotary 360 degree beacon

Numbers	Description
059-4812	Guard; Manhole-sub surface protection devices
686-0274	Stanchion base
686-0282	Stanchion pole
059-1487	Tape; Safety barrier
059-5520	Retractable cone — bar extends from 6' to 10' orange white
NS0108630	Barricade; Rail
NS0108629	Barricade; A-frame
NS0108632	28" cone
NS0108631	36" cone
024-1984	Flag; Red danger
680-0107	Safety vest; S/M
680-0102	Safety vest; L/XL
680-0101	Safety vest; 2XL/3XL
587-1579	LED work area protection lights



May 2014

Appendix G

Hazard Communication (HAZCOM) Program

Final

Hazard Communication (HAZCOM) Program

Policy and Purpose

GEI's policy is to furnish employees with a working environment safe from recognized hazards. This program is designed to provide GEI's compliance with OSHA's Federal Hazard Communication Standard (29 CFR 1910.1200 and 1926.59).

The GEI Hazard Communication (HAZCOM) Program has been compiled to provide guidelines meeting the requirements of OSHA's Hazard Communication Standard. This program addresses the evaluation of potential GEI workplace hazards and communication of these hazards to GEI employees.

Scope

In accordance with 29 CFR 1910.1200 and 1926.59, this program applies to any potentially hazardous chemical which is known to be present in the workplace in such a manner that employees may potentially be exposed under normal conditions of use. GEI employees speak and understand English; hazard communication is conveyed in English.

Location of Written Program

The written HAZCOM is located on the GEI Health and Safety intranet page.

Responsibilities

Overall coordination and implementation of GEI's HAZCOM Program is the responsibility of the CHSO. Any questions, comments, or suggestions relating to GEI's HAZCOM Program should be directed to the CHSO or the RHSOs. The following subsections delineate the responsibilities of personnel as required for successful implementation of this program.

Corporate Health and Safety Officer

The CHSO will:

- Develop and oversee implementation of the written HAZCOM Program.
- Track that field personnel engaged in hazardous waste operations receive OSHA 40-hour Health and Safety Training, 24-hour supervised on-the-job training, 8-hour Supervisory Training, and annual 8-hour Retraining as required by OSHA (29 CFR 1910.120 and 29 CFR 1926.65).
- Track that other personnel receive the general Health and Safety training and annual 4-hour refresher training as required by GEI.

Regional Health and Safety Officer

The RHSO will:

- Determine that all new employees in their region receive training in accordance with the GEI HAZCOM Program within 30 days of hire or prior to performing field work (whichever is sooner). This will be conducted in conjunction with the new employee health and safety orientation.
- Maintain at his/her office/branch an inventory of Safety Data Sheets (SDSs) as available for all hazardous materials with which employees have the potential of coming into contact with while on the job.
- Determine that SDSs are made readily available for employee review upon request by the employee.
- Determine that GEI's label and warning protocol for hazardous materials is complied with.
- Determine that field personnel are familiar with GEI's HAZCOM Program regarding chemical use and potential chemical exposures in the field.

Supervisors (Project Managers and/or Project Staff)

Project Managers and/or Field Team Leaders will:

- Develop and oversee completeness of site-specific HASPs for their projects.
- Implement the hazard communication programs and HASPs for their projects.
- Determine that field personnel are familiar with GEI's HAZCOM Program regarding site-specific chemical use and potential chemical exposures at the site.
- Determine that employees working on their project sites are familiar with site-specific HASPs and comply with the HASPs.
- Determine that copies of Safety Data sheets (SDS) for chemicals used in the field are attached to the final copy of the HASP and are reviewed by GEI field personnel.

Staff

It is the Staff's responsibility to:

- Read GEI's HAZCOM procedure within 30 days of employment by GEI or prior to performing field work for GEI (whichever is sooner).
- Gain familiarization with SDSs of those hazardous materials that they use or may be exposed to.
- Use information and measures learned from the GEI HAZCOM Program, including associated training and professional experiences, to protect themselves from adverse exposure to hazardous materials.

Program Requirements

Safety Data Sheets (MSDSs) and Chemical List

Safety Data Sheets (SDSs) will be obtained for each required chemical from the chemical manufacturer, supplier or vendor. Complete sets of SDSs for chemicals specific to each office/branch are maintained in each office and made readily available for review upon request by any employee. The content and location of the SDS binders varies by office location. SDS for the Denver Ecology laboratory are maintained in the lab under the direction of the Laboratory Manager.

The binders typically contain SDSs for:

- Chemicals that are typically used for decontamination. Supplies of these chemicals are generally kept in GEI field equipment storerooms.
- Chemicals that are typically used for sample preservation. Sample bottles typically come pre-preserved from the laboratories.
- Chemicals that may be encountered on typical GEI job sites such as decontamination chemicals and laboratory reagents. SDSs included in site-specific HASPs should be reviewed prior to performing field work on those sites.
- Chemicals used to calibrate instruments. These chemicals are generally kept in small quantities to be used only by instrument technical personnel.

If an employee needs an SDS for a specific chemical, they should contact the manufacturer (including searching the manufacturer's website) or distributor. If the chemical is a sample preservative, then the employee should contact the laboratory from which they ordered the glassware. SDSs must be retained for 30 years.

SDS for chemical products brought onto jobsites, such as laboratory reagents, decontamination supplies, and gasoline, diesel fuel or calibration gases, will be included in the site-specific HASP. GEI employees working on project sites with multiple employers will be given the opportunity to be informed of the chemicals at the project site through the Project Safety briefing conducted at the beginning on the project and through the safety briefings conducted during the project.

Before beginning a field assignment, an Activity Hazard Analysis (AHA) will be performed for each activity, routine and non-routine, which will be conducted by GEI personnel to determine what chemicals will be used. SDS will be included in the appendix of the Health and Safety Plan. Employees involved in non-routine tasks will discuss these tasks with the Project Manager, the CHSO or RHSO.

Label and Warnings

GEI's labeling system for containers of hazardous materials is as follows:

- Containers are labeled, tagged, or marked in a legible fashion, with the identity of the hazardous materials contained therein.
- Containers are labeled, tagged, or marked in a legible fashion with the appropriate hazard warnings. This warning may be of any type of message, words, pictures or symbols that convey the hazards of the chemical.
- All required container labels, tags and/or markings are legible.
- Labels are affixed to the container itself (vs. lid). Lids may also be labeled, but not in lieu of container labeling.
- GEI employees will not deface or remove labels from containers.

The GEI field equipment room maintenance technician is responsible that the GEI labeling system is complied with at his/her office location. Project Managers and project staff are responsible for determining that the GEI labeling system is complied with for the field portion of their projects.

Training

The GEI Office/Branch Manager is responsible for determining that the GEI personnel employed at his/her office/branch complies with the HAZCOM Program. Training records will be maintained for a minimum of three years.

GEI's HAZCOM Program training requirements are listed below:

- Newly hired employees who may use or be exposed to hazardous materials will be required to familiarize themselves with the GEI HAZCOM Program and with the SDSs associated with their job function.
  Employees will be required to attend a HAZCOM Program classroom training session as part of the annual HAZWOPER refresher training program or the general Health and Safety training program. Training will provide information on:

  - The physical and health hazards of the chemicals in the work area.
  - Methods and observations that may be used to detect the presence or release of a hazardous material.
  - Chemicals in the work area.
  - Measures employees can take to protect themselves from these hazards.
  - The details of the GEI HAZCOM Program, including an explanation of MSDSs and GEI's container labeling system.

Biennial Review

This program will be formally reviewed by the GEI CHSO and company management on a biennial basis or more frequently if the CHSO deems it necessary to promote personnel safety. The program will be revised as necessary for continuing compliance with the OSHA Federal Hazard Communication Standard.

office (e.g., a construction trailer), it's important that the workspace allows for proper social distancing.

- When traveling to project sites, travel in separate vehicles. Do not travel in the same vehicle.

Hygiene Practices

The hygiene practices we have been instructed to perform more routinely apply to performing field work as well, such as:

- Frequent hand washing with soap and warm water for 20 seconds. If soap and water are not readily available, use hand sanitizer (containing 60% alcohol) until soap and water can be used. If sanitizer is not available, bringing gallon containers of water and soap may be a good substitute.
- If you are filling water bottles (for drinking or hand washing) keep the bottle away from the spigot to avoid transfer of germs or contaminants.
- Wipe down surfaces with disinfectant on a routine basis (at least once per day). This includes field equipment and other items that may have previously been used by others. This is especially important while working in construction trailers. When using company and personal vehicles, wipe surfaces including the steering wheel, gear shifter, controls, and door handles before and after use.
- Wear nitrile gloves as frequently as possible. Hand washing is necessary after removing gloves.
- When greeting others avoid handshaking, hugging, or other personal contact. A greeting from a distance such as a wave is suggested.
- Avoid sharing field equipment and other materials with others. Before using field equipment or putting it away, wipe it down with disinfectant or wash it with soap and water. Note, use extra caution using disinfectants while collecting environmental samples to ensure that the samples are not compromised.

Table 2. Activity Hazard Analysis

General Hazards These Hazards Apply to All Site Activities	Control Measure
Coronavirus – COVID-19	• Maintain a distance of 6 feet from others. • If tasks needed to be performed close to others, limit time spent in close proximity. • When travelling to project site, travel in separate vehicles. • Frequent washing of hands with soap and warm water for 20 seconds. If soap is not available, use hand sanitizer with 60% alcohol. • Wipe down surfaces such as equipment surfaces, vehicle steering wheel, gear shifter, controls and door handles with disinfectant routinely before and after use. • Wear Nitrile gloves as frequently as possible. • Wash hands after gloves removal. • Avoid shaking hands, hugging, or other personal contact.

Final

Activity	Potential Hazard	Control Measures
Working near Water	Drowning, hypothermia	• While working near water stay inside guard rails and or barriers. • While working out of out of safety zones a personal flotation device (PFD) must be worn at all times and an approved 30-inch ring buoys will be readily available for emergency rescue operations. • Use appropriate fall protection. • Buddy system shall be in use. • See SOP HS-017

4.2.2.1 Underground Utilities

No excavating, drilling, boring, or other intrusive activities will be performed until an underground utility survey, conducted by knowledgeable persons or agencies, has been made. This survey will identify underground and in-workplace utilities such as the following:

- Electrical lines and appliances;
- Telephone lines;
- Cable television lines;
- Gas lines;
- Pipelines;
- Steam lines;
- Water lines;
- Sewer lines; and/or
- Pressurized air lines.

Please refer to GEI's SOP HS-014 Utility Mark Out (Appendix E) and Con Edison's – Utility Clearance Process for Intrusive Activities – Corporate EH&S Remediation Program (Appendix F). Dig Safely New York (Call 811) will be contacted to mark out utilities at the Site address prior to start of any intrusive activities. Be sure to have receipt of a utility mark out across the entire work area. Look for visible evidence of utility markings on the ground in the form of painted identifications for sewer, water, gas, communications, storm water, oil or petroleum, etc. It is required that prior to drilling, hand excavation occur, to minimally, 5 feet below ground surface, to pre-clear locations from utilities. Ensure that as part of the utility clearance process, the HPI Risk Assessment worksheet included in the Con Edison – Utility Clearance Process for Intrusive Activities is completed prior to the start of intrusive work.

The location of utilities will be discussed with GEI employees and subcontractors during a Site Safety Briefing. Identified utilities should be marked or access otherwise restricted to avoid chance of accidental contact.

Even when a utility search has been completed, drilling, boring, and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. Utilities will be considered "live" or active until reliable sources demonstrate otherwise.

Final

4.2.10 Working Near Water

The buddy system will be used when working near water, in which two persons operate as a single unit in order to monitor and assist each other in performing tasks. Personnel must be attired in a United States Coast Guard (USCG)-approved Type III or Type V work vest. The vest must be properly sized for the individual and must be secured. A throwable rescue device (Type IV personal flotation device [PFD] flotation aid) along with whatever equipment (i.e., ladders, lifting gear, or rescue boat) necessary will be immediately available to recover an individual from the water.

Waders may not be worn when working along, over, or in moving waters; or in waters influenced by tides or acted upon by waves when water depths exceed knee height unless specifically approved by the Safety Director. Waders may be worn in still waters and in water depths up to the waist, if bottom conditions are firm and well understood. Waders should never be worn aboard a watercraft.

Take special care on slippery rocks along shorelines, lakeshores, riverbanks, and creeks. Always look ahead at the ground when walking around the water's edge and avoid stepping on stones that have algal growth, especially those in intertidal areas, as these are extremely slippery. Employees should limit access to areas where these slip/fall hazards exist, especially in locations containing tidal water flow.

Table 4. Site-Specific PPE

Task	PPE Level	Site-Specific Requirements	Respirator
Mobilization/Demobilization			
Reconnaissance	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Mobilization/Demobilization of Equipment and Supplies	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D – None
Establishment of Site Security, Work Zones, and Staging Area	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Investigation/Construction			
Drilling,Groundwater Well Installation, Excavation, Backfilling, Sampling, Monitoring Well Repair, sediment sampling	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed, face coverings as required	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)
Remediation Observation			
Observe Contractor Activities	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed, face coverings as required	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)

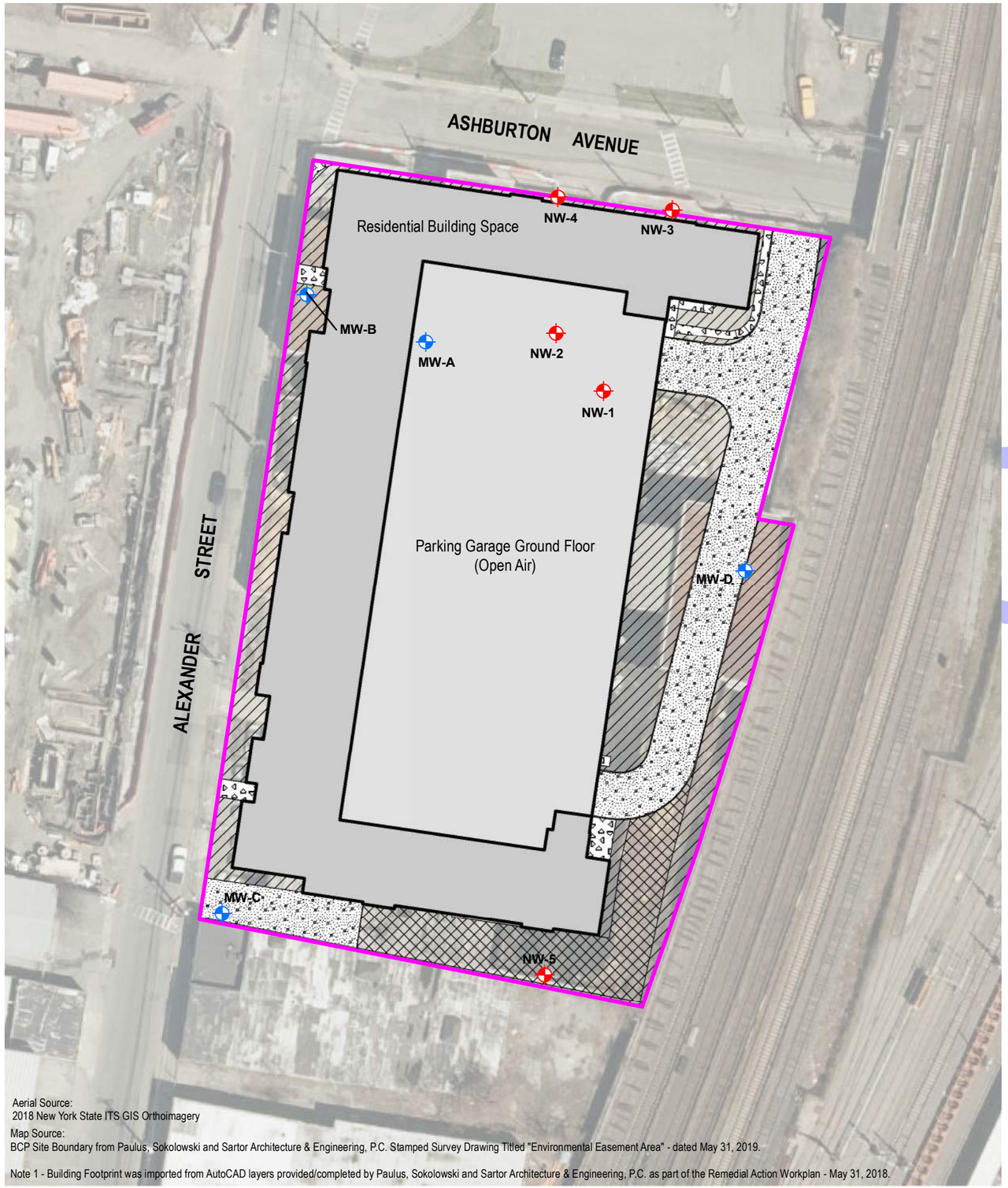
Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the Site and this HASP will be revised with oversight of the CHSO or GEI personnel will not re-enter the Site until conditions allow.

Final

2.2 Project Description

The project will include the installation of soil borings, test pits, subsurface soil sampling, installation and sampling of groundwater monitoring wells, installation of temporary soil vapor sampling probes, monitoring and recovery of dense nonaqueous phase liquids (DNAPL) onsite and at two adjacent properties, video inspections of the sewer system, and collection of surficial sediment samples at low tide on the bank of the Hudson River. This RI is intended to determine the nature and extent of MGP-related by-products on the Former Woodworth Avenue Works Site. All investigation activities will be conducted in accordance with this Health and Safety Plan (HASP) and Field Sampling Plan (FSP).

APPROVED



Aerial Source:
2018 New York State ITS GIS Orthoimagery

Map Source:
BCP Site Boundary from Paulus, Sokolowski and Sartor Architecture & Engineering, P.C. Stamped Survey Drawing Titled "Environmental Easement Area" - dated May 31, 2019.

Note 1 - Building Footprint was imported from AutoCAD layers provided/completed by Paulus, Sokolowski and Sartor Architecture & Engineering, P.C. as part of the Remedial Action Workplan - May 31, 2018.

APPROVED

LEGEND

- BCP SITE BOUNDARY
- RESIDENTIAL BUILDING SPACE
- PARKING GARAGE (OPEN AIR)
- SIDEWALK
- GRASS PAVER
- ASPHALT
- LANDSCAPED
- NAPL RECOVERY WELL LOCATION
- GROUNDWATER MONITORING WELL LOCATION

0 30 60 120

SCALE IN FEET

AKRF
34 S. Broadway #401, White Plains, NY 10601

Polychrome East
NYSDEC Site (BCP #C360098)
Yonkers, New York

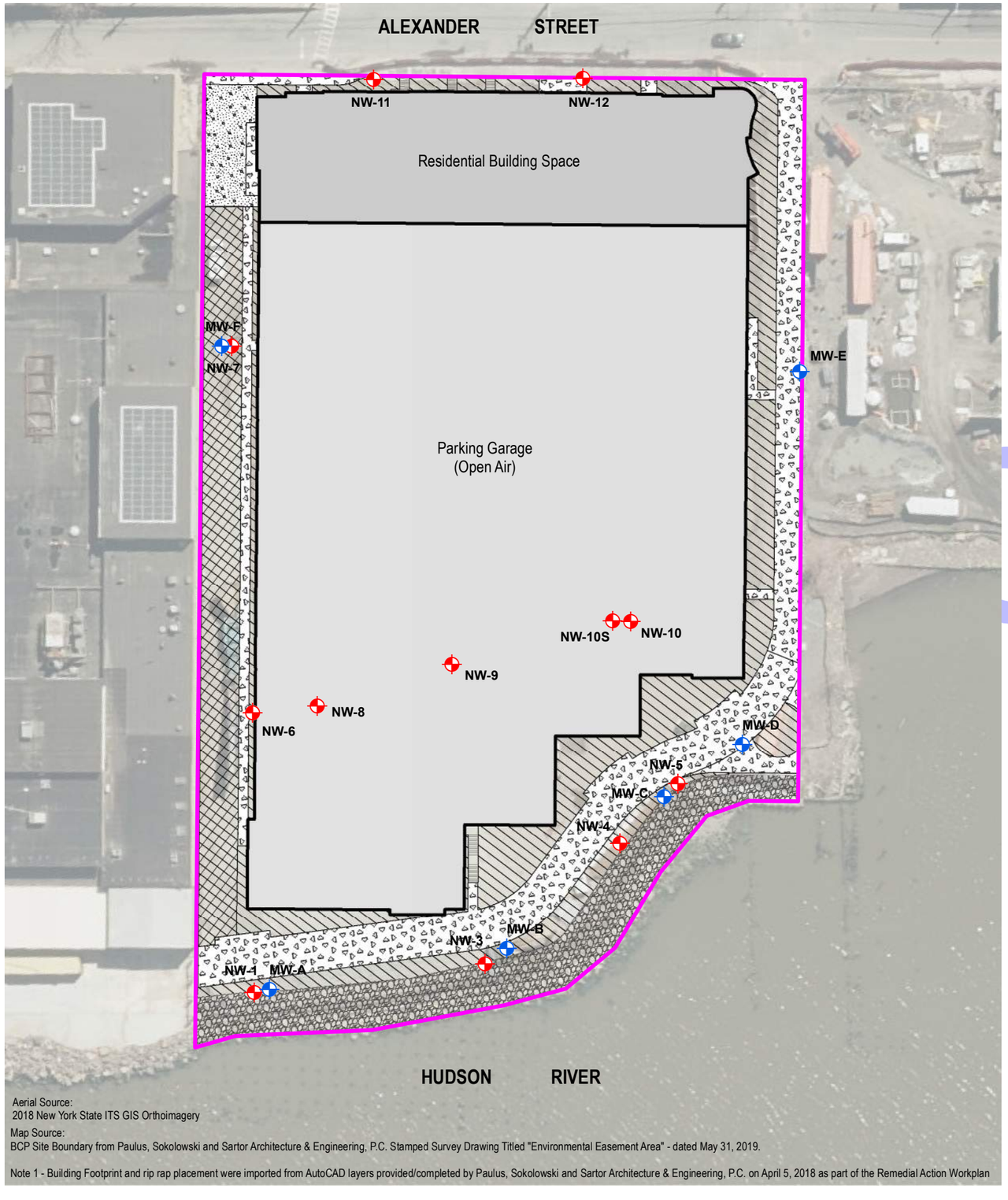
NAPL RECOVERY AND GROUNDWATER MONITORING WELLS

DATE
12/20/2019

PROJECT NO.
180132

FIGURE
7

©2019AKRF Q:\Projects\180132 - AVALONBAY YONKERS - BLD 3 - PCE\Technical\GIS and Graphics\Hazmat\FER\180132 Fig 7 NAPL Recovery and GW Wells.mxd12/20/2019 8:37:10 AM mvelleux



Aerial Source:
2018 New York State ITS GIS Orthoimagery

Map Source:
BCP Site Boundary from Paulus, Sokolowski and Sartor Architecture & Engineering, P.C. Stamped Survey Drawing Titled "Environmental Easement Area" - dated May 31, 2019.

Note 1 - Building Footprint and rip rap placement were imported from AutoCAD layers provided/completed by Paulus, Sokolowski and Sartor Architecture & Engineering, P.C. on April 5, 2018 as part of the Remedial Action Workplan

LEGEND

- BCP SITE
- RESIDENTIAL BUILDING
- PARKING GARAGE (OPEN
- ESPLANADE
- GRASS PAVER
- ASPHALT
- LANDSCAPED
- RIP RAP
- NAPL RECOVERY WELL
- GROUNDWATER MONITORING WELL LOCATION (SHALLOW NAPL RECOVERY)

0 30 60 120

SCALE IN FEET

APPROVED

AKRF
440 Park Avenue South, New York, NY 10016

Polychrome West
NYSDEC Site (BCP #C360099)
Yonkers, New York

NAPL RECOVERY & GROUNDWATER MONITORING WELL LOCATION PLAN

DATE
12/19/2019

PROJECT NO.
180017

FIGURE
7

©2019 AKRF Q:\Projects\180017 - AVALONBAY YONKERS - BLD 2 - PCW\Technical\GIS and Graphics\Hazmat\FER\180017 Fig 7 NAPL Recovery and GW Wells.mxd 12/19/2019 2:26:59 PM mvelleux

SAFETY DATA SHEET

Version 6.6
Revision Date 05/24/2022
Print Date 06/18/2022

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Acetone

Product Number : 179124
Brand : SIGALD
Index-No. : 606-001-00-8
CAS-No. : 67-64-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

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Hazard statement(s)

H225	Highly flammable liquid and vapor.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.

Precautionary statement(s)

P210	Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing mist or vapors.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Repeated exposure may cause skin dryness or cracking.

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	C_3H_6O
Molecular weight	:	58.08 g/mol
CAS-No.	:	67-64-1
EC-No.	:	200-662-2
Index-No.	:	606-001-00-8

Component	Classification	Concentration
acetone		
	Flam. Liq. 2; Eye Irrit. 2A; STOT SE 3; H225, H319, H336 Concentration limits: >= 20 %: STOT SE 3, H336;	<= 100 %

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For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Carbon dioxide (CO2) Foam Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Pay attention to flashback.
Vapors are heavier than air and may spread along floors.
Development of hazardous combustion gases or vapours possible in the event of fire.
Forms explosive mixtures with air at ambient temperatures.

5.3 Advice for firefighters
In the event of fire, wear self-contained breathing apparatus.

5.4 Further information
Remove container from danger zone and cool with water. Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Keep away from heat and sources of ignition.
Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains. Risk of explosion.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up with liquid-absorbent material (e.g. Chemizorb®).
Dispose of properly. Clean up affected area.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.

Advice on protection against fire and explosion
Keep away from open flames, hot surfaces and sources of ignition.Take precautionary measures against static discharge.

Hygiene measures
Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Keep container tightly closed in a dry and well-ventilated place. Keep away from heat and sources of ignition.

Storage class
Storage class (TRGS 510): 3: Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

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Component	CAS-No.	Value	Control parameters	Basis
acetone	67-64-1	TWA	250 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Not classifiable as a human carcinogen		
		STEL	500 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Not classifiable as a human carcinogen		
		TWA	250 ppm 590 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1,000 ppm 2,400 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		C	3,000 ppm	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		PEL	500 ppm 1,200 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		STEL	750 ppm 1,780 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
acetone	67-64-1	Acetone	25 mg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			

Predicted No Effect Concentration (PNEC)

Compartment	Value
Soil	33.3 mg/kg
Sea water	1.06 mg/l
Fresh water	10.6 mg/l
Sea sediment	3.04 mg/kg
Fresh water sediment	30.4 mg/kg
Onsite sewage treatment plant	100 mg/l

8.2 Exposure controls

Appropriate engineering controls

Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

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Skin protection
This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Full contact
Material: butyl-rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Butoject® (KCL 898)

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Splash contact
Material: Latex gloves
Minimum layer thickness: 0.6 mm
Break through time: 10 min
Material tested:Lapren® (KCL 706 / Aldrich Z677558, Size M)

Body Protection
Flame retardant antistatic protective clothing.

Respiratory protection
required when vapours/aerosols are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains. Risk of explosion.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: clear, liquid Color: colorless
b)	Odor	pungent, weakly aromatic
c)	Odor Threshold	0.1 ppm
d)	pH	5 - 6 at 395 g/l at 20 °C (68 °F)
e)	Melting point/freezing point	Melting point/range: -94 °C (-137 °F) - lit.
f)	Initial boiling point and boiling range	56 °C 133 °F at 1,013 hPa - lit.
g)	Flash point	-17.0 °C (1.4 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid,	No data available

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	gas)	
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 13 %(V) Lower explosion limit: 2 %(V)
k)	Vapor pressure	245.3 hPa at 20.0 °C (68.0 °F)
l)	Vapor density	No data available
m)	Density	0.791 g/cm3 at 25 °C (77 °F) - lit.
	Relative density	No data available
n)	Water solubility	soluble, in all proportions
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	465.0 °C (869.0 °F)
q)	Decomposition temperature	Distillable in an undecomposed state at normal pressure.
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

Conductivity	0.01 µS/cm at 20 °C (68 °F)
Surface tension	23.2 mN/m at 20.0 °C (68.0 °F)

SECTION 10: Stability and reactivity

10.1 Reactivity

Vapors may form explosive mixture with air.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Risk of ignition or formation of inflammable gases or vapours with:
chromosulfuric acid
chromyl chloride
ethanolamine
Fluorine
Strong oxidizing agents
strong reducing agents
Nitric acid
chromium(VI) oxide
Risk of explosion with:
nonmetallic oxyhalides
halogen-halogen compounds
Chloroform
nitrating acid
nitrosyl compounds

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hydrogen peroxide
halogen oxides
organic nitro compounds
peroxi compounds
Exothermic reaction with:
Bromine
Alkali metals
alkali hydroxides
Halogenated hydrocarbon
Sulfur dichloride
phosphorous oxichloride

10.4 Conditions to avoid
Warming.

10.5 Incompatible materials
rubber, various plastics

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - female - 5,800 mg/kg
Remarks: (ECHA)
LC50 Inhalation - Rat - 4 h - 76 mg/l - vapor

Remarks: Unconsciousness
Drowsiness
Dizziness
(External MSDS)
LD50 Dermal - Rabbit - 20,000 mg/kg
Remarks: (IUCLID)
No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Mild skin irritation - 24 h
(Draize Test)
Remarks: (RTECS)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Eye irritation - 24 h
(Draize Test)
Remarks: (RTECS)

Respiratory or skin sensitization
Maximization Test - Guinea pig
Result: Not a skin sensitizer.
Remarks: (ECHA)
Chronic exposure may cause dermatitis.

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Germ cell mutagenicity
Test Type: Mutagenicity (mammal cell test): chromosome aberration.
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 473
Result: negative
Test Type: Ames test
Test system: Salmonella typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
Test Type: In vitro mammalian cell gene mutation test
Test system: Mouse lymphoma test
Metabolic activation: without metabolic activation
Method: OECD Test Guideline 476
Result: negative

Carcinogenicity

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
Inhalation - May cause drowsiness or dizziness. - Narcotic effects

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: AL3150000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

Headache
Salivation
Nausea
Vomiting
Dizziness
narcosis
Coma

Other dangerous properties can not be excluded.

Handle in accordance with good industrial hygiene and safety practice.

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Kidney - Irregularities - Based on Human Evidence

Skin - Dermatitis - Based on Human Evidence

Kidney - Irregularities - Based on Human Evidence

Skin - Dermatitis - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Pimephales promelas (fathead minnow) - 6,210 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	static test LC50 - Daphnia pulex (Water flea) - 8,800 mg/l - 48 h Remarks: (ECHA)
Toxicity to algae	static test NOEC - M.aeruginosa - 530 mg/l - 8 d (DIN 38412) Remarks: (maximum permissible toxic concentration) (IUCLID)
Toxicity to bacteria	static test EC50 - activated sludge - 61.15 mg/l - 30 min (OECD Test Guideline 209)

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 28 d Result: 91 % - Readily biodegradable. (OECD Test Guideline 301B)
Biochemical Oxygen Demand (BOD)	1,850 mg/g Remarks: (IUCLID)
Chemical Oxygen Demand (COD)	2,070 mg/g Remarks: (IUCLID)
Theoretical oxygen demand	2,200 mg/g Remarks: (Lit.)

12.3 Bioaccumulative potential

Does not bioaccumulate.

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)
UN number: 1090 Class: 3 Packing group: II
Proper shipping name: Acetone
Reportable Quantity (RQ): 5000 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 1090 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: ACETONE

IATA
UN number: 1090 Class: 3 Packing group: II
Proper shipping name: Acetone

SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

SECTION 16: Other information

Further information
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See

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Version: 6.6 Revision Date: 05/24/2022 Print Date: 06/18/2022

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COLGATE-PALMOLIVE Company
SAFETY DATA SHEET

AJAX CLEANER POWDER-OXYGEN BLEACH

This industrial Safety Data Sheet is not intended for consumers and does not address consumer use of the product. For information regarding consumer applications of this product, refer to the product label.

Version 1.1 SDS Number: 660000000222 Revision Date: 05/14/2015

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : AJAX CLEANER POWDER-OXYGEN BLEACH

Product code : 200000017621

: B01809190000

Manufacturer or supplier's details

Company : Colgate-Palmolive Co
Commerical Consumer Group
191 East Hanover Avenue
Morristown, NJ 07960-3151

Telephone : US: Consumer Affairs - 1-800-468-6502

Emergency telephone number : For emergencies involving spill, leak, fire, exposure or accident call CHEMTREC (24hr) at (800) 424-9300 or (703) 527-3887.

Medical Emergency (24HR): For MEDICAL EMERGENCIES involving this product call: (888) 489-3861

Recommended use of the chemical and restrictions on use

Recommended use : A formulated multi-purpose cleaner

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	powder
Colour	off-white

GHS Classification

Acute toxicity (Inhalation) : Category 4

GHS Label element

Hazard pictograms :



Signal word : Warning

Hazard statements : H332 Harmful if inhaled.

Precautionary statements : **Prevention:**
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P271 Use only outdoors or in a well-ventilated area.
Response:
P304 + P340 + P312 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.

Potential Health Effects

Inhalation : May be harmful if inhaled.

Skin : May cause skin irritation upon prolonged contact.

Eyes : Causes eye irritation on direct contact.

Ingestion : May be harmful if swallowed in large quantities.

Aggravated Medical Condition : None known.

Carcinogenicity:

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

OSHA No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

NTP No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous components

Chemical Name	CAS-No.	Concentration (%)
LIMESTONE	1317-65-3	>= 90 - <= 100
SODIUM CARBONATE	497-19-8	>= 5 - < 10

SECTION 4. FIRST AID MEASURES

If inhaled : Remove victim to fresh air. Get medical attention, if symptoms persist.

In case of skin contact	:	Flush skin with large amounts of water. If irritation develops and persists, get medical attention.
In case of eye contact	:	Flush eyes with water at least 15 minutes. Get medical attention if eye irritation develops or persists.
If swallowed	:	Drink 8 ounces of clear water. Get medical attention.
Most important symptoms and effects, both acute and delayed	:	Harmful if inhaled.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Hazardous combustion products	:	No hazardous combustion products are known
Special protective equipment for firefighters	:	Self-contained breathing apparatus and full protective clothing should be worn when fighting chemical fires.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protection recommended in Section 8 of the SDS.
Methods and materials for containment and cleaning up	:	Cover with inert, absorbent material and remove to disposal container. Spill area may be slippery. Flush with plenty of water.

SECTION 7. HANDLING AND STORAGE

Conditions for safe storage	:	Store at controlled room temperature at 20-25°C (68-77°F).

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
LIMESTONE	1317-65-3	TWA (Respirable)	5 mg/m3	NIOSH REL
		TWA (total)	10 mg/m3	NIOSH REL
		TWA (Respirable)	5 mg/m3	NIOSH REL

		TWA (total)	10 mg/m3	NIOSH REL
		TWA (total dust)	15 mg/m3	OSHA Z-1
		TWA (respirable fraction)	5 mg/m3	OSHA Z-1
		TWA (Total dust)	15 mg/m3	OSHA P0
		TWA (respirable dust fraction)	5 mg/m3	OSHA P0

Engineering measures : In an industrial work environment, no special precautions or control measures are required.

Personal protective equipment

Respiratory protection : General and local exhaust ventilation is recommended to maintain vapor exposures below recommended limits. Where concentrations are above recommended limits or are unknown, appropriate respiratory protection should be worn. Follow OSHA respirator regulations (29 CFR 1910.134) and use NIOSH/MSHA approved respirators. Protection provided by air purifying respirators against exposure to any hazardous chemical is limited. Use a positive pressure air supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstance where air purifying respirators may not provide adequate protection.

Protective measures : In an industrial work environment, if a splash is likely, chemical goggles may be needed. Prolonged skin contact may require protective gloves. For consumer use, no unusual precautions are necessary.

Hygiene measures : In an industrial work environment, avoid eye and prolonged skin contact.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : powder

Colour : off-white

pH : 10.4

Flash point : No data available

Density : 1.04 g/cm3

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur.
Incompatible materials	:	Strong oxidizing agents
Hazardous decomposition products	:	None known.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Harmful if inhaled.

Product:

Acute oral toxicity	:	Acute toxicity estimate : > 5,000 mg/kg Method: Calculation method
Acute inhalation toxicity	:	Acute toxicity estimate : 1.63 mg/l Exposure time: 4 h Test atmosphere: dust/mist Method: Calculation method

Components:

LIMESTONE:

Acute oral toxicity	:	LD50 (Rat): > 2,000 mg/kg Method: OECD Test Guideline 420
Acute inhalation toxicity	:	LC50 (Rabbit): > 3 mg/l Exposure time: 4 h Test atmosphere: dust/mist Method: OECD Test Guideline 403
Acute dermal toxicity	:	LD50 (Rat): > 2,000 mg/kg Method: OECD Test Guideline 402

SODIUM CARBONATE:

Acute oral toxicity	:	LD50 (Rat): 2,800 mg/kg
Acute inhalation toxicity	:	LC50 (Rabbit): 2.3 mg/l Exposure time: 2 h Test atmosphere: No information available. Method: No information available.
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg Method: No information available.

Skin corrosion/irritation

Not classified based on available information.

Components:

LIMESTONE:

Result: No skin irritation

SODIUM CARBONATE:
Remarks: No data available

Serious eye damage/eye irritation

Not classified based on available information.

Components:

LIMESTONE:
Result: No eye irritation

SODIUM CARBONATE:
Result: Irritation to eyes, reversing within 21 days

Respiratory or skin sensitisation

Skin sensitisation: Not classified based on available information.
Respiratory sensitisation: Not classified based on available information.

Components:

LIMESTONE:
Exposure routes: Inhalation
Result: Does not cause respiratory sensitisation.

Exposure routes: Dermal
Result: Does not cause skin sensitisation.

SODIUM CARBONATE:
Exposure routes: Inhalation
Remarks: No data available

Exposure routes: Dermal
Remarks: No data available

Germ cell mutagenicity

Not classified based on available information.

Carcinogenicity

Not classified based on available information.

Reproductive toxicity

Not classified based on available information.

STOT - single exposure

Not classified based on available information.

STOT - repeated exposure

Not classified based on available information.

Aspiration toxicity

Not classified based on available information.

Further information

Product:

Remarks: This product has not been tested as a whole. However, this formula was reviewed by expert toxicologists in the Product Safety Assurance Department of Colgate-Palmolive and is determined to be safe for its intended use. This review has taken into consideration available safety-related information including information on individual ingredients, similar formulas and potential ingredient interactions. This review is a component of the hazard determination used to prepare the statements in Section 3 of the SDS.

SECTION 12. ECOLOGICAL INFORMATION

The product has not been tested as a whole for environmental toxicity. However, environmental information on the ingredients in this product have been reviewed by the Environmental, Health and Safety group of Colgate-Palmolive and determined to have an acceptable environmental profile. This evaluation is based on available information on individual ingredients, interactions of ingredients, and similar ingredients. Biodegradability claims are supported by data on ingredients (i.e., surfactants are biodegradable) or testing conducted on the final product (i.e., This product is biodegradable).

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Any disposal practice must be in compliance with local, state and federal laws and regulations (contact local or state environment agency for specific rules). Do not dump in sewers, any body of water or on the ground.

SECTION 14. TRANSPORT INFORMATION

DOT : Not regulated.

TDG : Not regulated.

IATA : Not regulated.

IMDG : Not regulated.

International Regulation

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

SECTION 15. REGULATORY INFORMATION

OSHA Hazards : Combustible dust, Moderate skin irritant, Severe eye irritant

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
SODIUM DODECYL BENZENE SULFONATE	25155-30-0	1000	*

*: Calculated RQ exceeds reasonably attainable upper limit.

SARA 304 Extremely Hazardous Substances Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
SULFUR DIOXIDE	7446-09-5	500	*

*: Calculated RQ exceeds reasonably attainable upper limit.

SARA 311/312 Hazards : Acute Health Hazard

SARA 302 : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 12 (40 CFR 61).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

The following Hazardous Substances are listed under the U.S. CleanWater Act, Section 311, Table 116.4A:

SODIUM DODECYL BENZENE SULFONATE	25155-30-0
Sulfuric Acid	SULFURIC ACID

The following Hazardous Chemicals are listed under the U.S. CleanWater Act, Section 311, Table 117.3:

SODIUM DODECYL BENZENE SULFONATE	25155-30-0
Sulfuric Acid	SULFURIC ACID

This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

Massachusetts Right To Know

LIMESTONE	1317-65-3
SODIUM DODECYL BENZENE SULFONATE	25155-30-0
Sulfuric Acid	SULFURIC ACID
SULFUR DIOXIDE	7446-09-5

Pennsylvania Right To Know

LIMESTONE	1317-65-3
SODIUM CARBONATE	497-19-8
SODIUM DODECYL BENZENE SULFONATE	25155-30-0
Sulfuric Acid	SULFURIC ACID
SULFUR DIOXIDE	7446-09-5
SODIUM SULFATE	7757-82-6

New Jersey Right To Know

LIMESTONE	1317-65-3
SODIUM CARBONATE	497-19-8
SODIUM DODECYL BENZENE SULFONATE	25155-30-0

California Prop 65 : This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

The components of this product are reported in the following inventories:

TSCA : All ingredients in this product are listed on the TSCA Inventory or are not required to be listed on the TSCA Inventory.

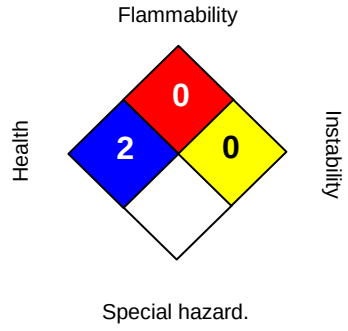
Inventories

AICS (Australia), DSL (Canada), IECSC (China), REACH (European Union), ENCS (Japan), ISHL (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TSCA (USA)

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	2
FLAMMABILITY	0
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Disclaimer: The information on this sheet is limited to the material identified and is believed by the Colgate-Palmolive Company to be correct based on its knowledge and information as of the date noted. Colgate makes no representation, guarantee or warranty, expressed or implied, as to the accuracy, reliability or completeness of the information and assumes no responsibility for injury, damage or loss resulting from the use of the material.

2.2 Project Description

The project is focused on remediation of MGP-impacted soil identified on Site in previous investigations. Remedial activities include the removal of MGP source material within the foundation of former Holder No. 2, immobilization of remaining MGP impacts within the former holder beneath the groundwater table with Controlled Low Strength Material (Flowable Fill), backfill with clean import fill material, and restoration of the disturbed area with asphalt pavement. Additional activities including the installation of soil borings, test pits, subsurface soil sampling, installation and sampling of groundwater monitoring wells, installation of temporary soil vapor sampling probes, monitoring and recovery of dense nonaqueous phase liquids (DNAPL), video inspections of the sewer system, and collection of sediment samples at low tide on the bank of the Hudson River may be performed through the ongoing work at the Site.

2.2 Project Description

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