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Pre-Design Investigation Work Plan

RG&E West Station Plant Area
Former Manufactured Gas Plant (MGP) Site
Rochester, New York

Site No. V00593-8
Index No. B-0535-98-07

Submitted to:
Rochester Gas & Electric
Rochester, New York

Submitted by:
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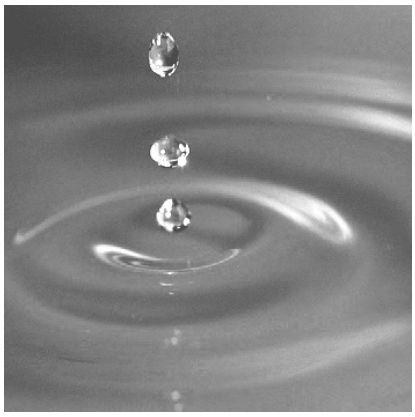

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Abbreviations and Acronyms

AA	Alternative Analysis
ASTs	Above Ground Storage Tanks
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAMP	Community Air Monitoring Plan
COPCs	Constituents of Potential Concern
CTF	Central Water Treatment Facility
DER	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
feet bgs	feet below ground surface
feet msl	feet above mean sea level
FWIA	Fish and Wildlife Impact Analysis
GEI	GEI Consultants, Inc., P.C.
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
ICs	Institutional Controls
MGP	Manufactured Gas Plant
MNA	Monitored Natural Attenuation
NAPL	Non-Aqueous Phase Liquid
NYCRR	Codes, Rules and Regulations of the State of New York
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDI	Pre-Design Investigation
PID	Photoionization Detector
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
RAOs	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RG&E	Rochester Gas and Electric

Abbreviations and Acronyms

RI	Remedial Investigation
SCGs	Standards, Criteria, and Guidance
SCOs or RSCO	Soil Cleanup Objectives or Recommended Soil Cleanup Objectives
SMP	Site Management Plan
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TLM	Tar-Like Material
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
USFWS	United State Fish and Wildlife Service
VCA	Voluntary Cleanup Agreement
VOCs	Volatile Organic Compounds

Certification

I Kelly R. McIntosh certify that I am currently a NYS registered professional engineer and that this Pre-Design Investigation 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).

Kelly R. McIntosh, Ph.D., P.E.

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GEI Consultants, Inc., P.C.

5/31/18

Executive Summary

GEI Consultants, Inc., P.C. (GEI) was retained by Rochester Gas and Electric (RG&E) to prepare a Pre-Design Work Plan for the West Station Plant Area Former Manufactured Gas Plant (MGP) Site (Site No. V00593-8), located in Rochester, New York.

Nature and Extent of MGP Impacts

MGP residual materials were identified in soil at the site. Comparatively low concentrations of BTEX and PAHs were detected in on-site groundwater. The low concentrations indicate natural biological processes effectively attenuate dissolved phase constituents in groundwater. Municipal water is available at the site and no future uses of on-site groundwater are foreseen. While no complete human health exposure pathways exist under current conditions, some possible exposure scenarios were identified including a scenario where subsurface construction activity occurs without a proper Site Management Plan (SMP). An environmental easement limiting site use is planned to be used to eliminate use exposure scenarios. Significant ecological resources do not reside on the Site and no threatened or endangered species of fish or benthic invertebrates were identified in the near-shore environment. Although the potential adverse impacts to the aquatic community as a whole were determined to be very low, the Fish and Wildlife Impact Analysis concluded that elevated concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) in soil adjacent to the Genesee River and in the near-shore river sediments may pose a potential threat to benthic populations adjacent to portions of the site. New York State Department of Environmental Conservation (NYSDEC) approved the RI Report by letter dated January 15, 2013.

The NYSDEC approved the AA Report in correspondence dated January 28, 2016.

Alternative 3 of the AA Report is the recommended alternative and is comprised of the following components (includes modifications requested by NYSDEC in subsequent comments):

- Institutional controls (ICs) that include: Site access restrictions (maintain site fencing); site management plan (SMP) identifying soil management protocols; and groundwater and land use prohibitions (incorporated into an environmental easement as appropriate)

- Removal and off-site disposal of known and reasonably accessible underground process piping associated with the former MGP.

- River Side Excavation: Excavation of soil containing MGP residual material (DNAPL, TLM and/or purifier waste) that is identifiable visually as a distinct phase from the River Side of the Site (encompassing the soil between the river and the retaining wall and the

river bank south of the retaining wall). River Side soil excavation will terminate in a northern lateral direction and at the depth where MGP residual material is not observed.

- Construction of near-shore water diversion structures (temporary sheet pile or other means) and excavation of visually impacted Genesee River Sediment (limits as determined by RI and Pre-Design Investigation findings).
- Off-Site disposal of excavated visually impacted near-shore sediment at a permitted facility.
- Reconstruction with restoration as applicable of the river bank.
- Predesign Investigation for: extent of visual impacted soil on the River Side soil excavation area, assessment of existing retaining wall integrity and repair, and data required to support design of near-shore water diversion structures.
- Extension of the existing site retaining wall approximately 360 feet to the south (southern terminus keyed into the intake/discharge barrier wall).
- Installation of passive DNAPL recovery wells along the upgradient (Land Side) of the retaining wall (existing and extended) to be evacuated regularly if DNAPL accumulates.
- Soil Cap, inclusive of site re-grading to accommodate a 24-inch thickness of clean imported cover soils to allow for restricted residential use of the site with placement of a demarcation layer between the site soils and the cover soils. Pavement may be used in lieu of cover soils where appropriate (e.g., roadways, driveways and parking areas).
- Implementation of an MNA or enhanced MNA program to monitor the quality of groundwater migrating from the Site and/or enhance natural attenuation.

Remedial Action Work Plan

A RAWP was prepared and finalized with NYSDEC approval in correspondence dated May 23, 2017. The RAWP identified a need for preparation of the following plans to support detailed plans and specifications for Remedial Design:

- Remedial Facilities Plan
- Pre-Design Investigation Work Plan
- Site Health and Safety Plan with Community Air Monitoring Plan
- Dust, Odor, and Vapor Control Plan
- Erosion and Sediment Control Plan and River Turbidity Monitoring/Sheen Observance Plan

- Materials Management Plan
- Decontamination Plan
- Soil Hauling and Traffic Control Plan
- Citizen Participation Plan Updates
- Site Management Plan and Environmental Easement (Post Construction)

Decision Document

The NYSDEC executed a Decision Document on February 20, 2018 describing the remedy for the West Station Former MGP Site following receipt of written comments from the public. The Declaration Statement of the Decision Document is presented in Appendix A.

Pre-Design Investigation Work Scope

The PDI consists of the following elements which have been segregated into work tasks taking place on the Land Side of the Site (west of the concrete retaining wall) and work tasks taking place on the River Side of the Site.

Land Side Work:

New Barrier Wall Characterization: Test pits, soil borings and bedrock cores will be completed along the alignment of the new barrier wall between the southern terminus of the Existing Barrier Wall and the former Beebe Station concrete intake structure. Before any intrusive activity, Ground Penetrating Radar (GPR) and/or an Electromagnetic (EM) survey will be completed to preliminarily identify subsurface obstructions. Investigation data will be used to characterize soil and upper bedrock conditions along the new wall alignment as well as identify the potential presence of historic structures, utilities or foundations that intersect the approximate wall alignment and that require consideration during design.

River Side Work:

Existing Retaining Wall Integrity: Since the proposed remedial action (Alternative 3) entails excavation of soils adjacent to the existing retaining wall, the condition and integrity of the existing retaining wall barrier will be examined. The purpose of the pre-design investigation will be to evaluate the need for precautionary or stabilization measures that may be required during excavation (to avoid damaging the structure) and to identify repairs which may be necessary (if any) prior to restoration. The remedy includes excavation of soils on the River Side of the retaining wall. The characterization will expose the bedrock surface along the River Side of the wall near locations where DNAPL has been observed (near wells GMX-MW-19S and GMX-MW-25S) and inspect the base of the wall and the bedrock surface for signs of DNAPL seepage.

North Area River Side Soil Characterization: Test pits will be excavated on the River Side of the site between the northern site boundary and the northern extent of soil excavation proposed in the RAWP. The test pits will be used to visually inspect soils in the area of the site for DNAPL/TLM presence and to facilitate the collection of soil samples. Soil samples will be collected from the test pits for analysis to support detail design which will refine the extent of River Side soil excavation at the north end of the site, if necessary.

Near Shore River Sediment Characterization: Surface water diversion during near shore sediment removal will require diversion of surface water in the Genesee River. Design data which includes the extent and thickness of boulder and cobble-size materials in the river, total riverbed thickness and bedrock topography, as well as additional sediment quality data for near-shore sediments along the north end of the Site. This activity will be coordinated with RG&E's Hydro Group.

Health and Safety Plan

A project-specific Health and Safety Plan (HASP) has been developed for the PDI field activities which protects worker safety by describing safe working practices includes a Community Air Monitoring Plan that complies with the general guidelines promulgated by the New York State Department of Health.

Management of Investigation Derived Waste

Investigation-Derived Waste (IDW) generated during completion of the PDI will be managed in a manner consistent with the DEC-approved 2008 Remedial Investigation Work Plan.

1. Introduction

This Pre-Design Investigation (PDI) Work Plan has been prepared by GEI Consultants, Inc., P.C. (GEI) on behalf of Rochester Gas and Electric Corporation (RG&E) for the West Station Plant Area Former Manufactured Gas Plant (MGP) Site (Site No. V00593-8), located in Rochester, New York (Figure 1). This PDI Work Plan describes investigation activities to support detailed remedial design of selected remedial action to address impacts to soil, sediment and groundwater from historic Industrial site operations related to Manufactured Gas Plant Operations which occurred from the late 1890s through the late 1940s. These impacts are generally associated with the former MGP and the associated presence of coal tar constituents.

This PDI Work Plan has been prepared consistent with the requirements of Voluntary Cleanup Agreement (VCA) Index Number B-0535-98-07 between RG&E and the New York State Department of Environmental Conservation (NYSDEC), effective April 10, 2003 and Amended December 23, 2014. The selected Remedial Action is based on the findings of the Remedial Investigation (RI) of the West Station Former MGP Plant Area Site (December 2010), additional sampling programs conducted both on-site and off-site, and the Alternative Analysis (AA) Report (March 2013). NYSDEC approved the AA Report in correspondence dated January 28, 2016 and Remedial Action Work Plan (RAWP) (June 2017).

1.1 PDI Work Plan Objective

As recommended in the RAWP, a PDI is necessary to support detailed remedial design. The objective of the PDI Work Plan is to describe the field methods and data to be collected during the PDI activities. The information obtained from the PDI will be summarized and presented in a PDI Report which will provide a basis for detailed design of remedial actions.

1.2 PDI Work Plan Outline

This Work Plan contains eight (8) sections.

- The remainder of Section 1.0 includes a description of the Site and its setting and briefly presents the findings of remedial investigations conducted on and off property.
- Section 2.0 describes the constituents of potential concern and remedial action objectives.
- Section 3.0 presents the selected Remedial Action.
- Section 4.0 presents scope of work for PDI.

- Section 5.0 presents the Site HASP with Community Air Monitoring.
- Section 6.0 describes decontamination and management of investigation-derived waste.
- Section 7.0 describes the Pre-Design Investigation Report
- Section 8.0 presents the proposed schedule for the Pre-Design Investigation.

1.3 Background Information

The West Station Site is a former MGP located at 254 Mill Street in Rochester, Monroe County, New York (Figure 1). The Site is presently owned by RG&E and, as shown on Figure 2, is bounded by the former RG&E Power Station No. 3 (decommissioned Beebee Station electric generation plant) situated on Mill Street and Falls Street to the west, the former City of Rochester garbage reduction plant to the north, the Genesee River to the east, and the Platt Street Bridge on the south. The area of the Site south of the Platt Street Bridge was called the "Park Area" of the West Station Site (which was remediated by RG&E in accordance with VCA Index No. D8-0001-95-10), while the remaining portion of the West Station Site was referred to as the "Plant Area". The former MGP processes were located on the Plant Area portion of the Site and encompass approximately 7 acres and operated between the early 1900s and 1952. MGP process included a manufactured gas from a retort building, a carbureted water gas building, and a coking building. The Site is relatively flat, with an average ground elevation of approximately 412 feet above mean sea level (feet msl). Several buildings utilized by RG&E for equipment storage remain on the property (Buildings 16, 17, and 18). All other buildings and above ground structures were removed historically or during recent decommissioning of Beebee Station. The Site is transected in the south-central portion of the plant by a decommissioned underground water intake/discharge structure associated with the former Beebee Station. The intake/discharge structure is a concrete structure installed partially into bedrock. The historic site features on RG&E property including the location of the intake/discharge structure are shown on Figure 2.

1.4 Summary of Remedial Investigation

The RI was conducted by Geomatrix Consultants, Inc. and AMEC Environment & Infrastructure, Inc. (AMEC) in 2008-2010 (with supplemental work completed in 2012). The RI incorporated results of previous investigations at the Site. The RI included Site characterization activities, evaluation of the extent of impact and potential chemical migration pathways from the Site, Human Health Risk Assessment (HHRA) and Fish and Wildlife Impact Analysis (FWIA). NYSDEC approved the completed RI by letter dated January 15, 2013.

1.4.1 Site Topography

The Site is differentiated topographically into two areas: the "Land Side" area and the "River Side" area. The Land Side area is characterized by generally flat topography, with ground surface elevations varying between 410 and 415 feet msl. The River Side area is characterized by lower elevations ranging between 399 and 396 feet msl, and is separated from the Land Side area by a concrete retaining wall in the northern portion of the Site. In the central and southern portions of the Site, the Land Side and River Side areas are separated by a low-profile stone retaining wall and other infrastructure associated with the adjacent former Beebee Station property. The topography slopes down abruptly from the elevated Land Side area to the edge of the Genesee River.

1.4.2 Geology/Hydrogeology

The Site is located within the Genesee River Gorge. The Site is situated on a bench consisting predominantly of fill material emplaced during Site construction. A thin, discontinuous layer of native alluvium exists between the fill material and bedrock, and is prevalent in undisturbed areas, and where former raceways existed prior to Site development. The uppermost bedrock unit encountered at the Site is the Rochester Shale, which also forms the floor and sidewalls of the gorge in the immediate vicinity of the Site.

Investigations of the Site identified fill material ranging between 9 and 38 feet in thickness (placed during the late 1800s and early 1900s west of the concrete retaining wall constructed parallel with the River shore line). Fill consists of a silty sand and gravel matrix with coal, cinders, and brick. The fill material was generally present above several feet of alluvium. The fill and alluvium, which comprise the overburden, is largely unsaturated. The depth to the water table is approximately 18 feet below ground surface across the majority of the site.

Depth to bedrock varies between 8.5 feet at the GMX-MW-16 monitoring well series to a maximum depth of 35.3 feet at soil boring SB-13. The bedrock beneath the property was investigated to a depth of 96 feet. The bedrock units cored and sampled (groundwater) are, sequentially:

- Rochester Shale (30 feet in thickness)
- Irondequoit Limestone (20 feet in thickness)
- Williamson Shale (5 feet in thickness)
- Sodus Shale (15 feet in thickness)
- Reynales Limestone (maximum thickness not determined during RI however it was cored 5 feet during the RI)

In the overburden, groundwater flow occurs generally to the east in the southern portion of the Site. In the northern portion of the site, the concrete retaining wall, which is keyed into bedrock, prevents the flow of overburden groundwater toward the River as shown by a nearly flat hydraulic gradient in the northeast corner of the site. The hydraulic gradient steepens in a southeasterly direction toward the south terminus of the wall.

Bedrock groundwater flow in the Rochester Shale beneath the Site is generally to the east. Flow in the deeper bedrock (Irondequoit Limestone and deeper formations) is toward the northeast.

1.4.3 Nature and Extent of MGP-Related Impacts

1.4.3.1 MGP Residual Materials

Occasional observations of MGP residual material were identified during the RI in site media in primarily three forms: Tar-Like Material (TLM); Dense Non-Aqueous Phase Liquid (DNAPL); and, less frequently, suspected gas purifier material.

TLM is a solidified (non-flowable) material defined in the RI as a solid or semi-solid tar. Its consistency ranges from hard solid (resistant to deformation) to a softer taffy-like semi-solid. DNAPL is a flowable organic liquid material and has been observed as discontinuous blebs or globules in water-saturated soil.

The presence of TLM was identified primarily in overburden soils on the River Side of the Site, and on the Land Side near Building 18 in the area of the former primary and secondary MGP cooler structures, and sporadically in the southern portion of the site. TLM was most often found in unsaturated fill material. TLM was not observed in bedrock below the overburden.

DNAPL present as discontinuous blebs and globules was observed in 23 soil borings Site-wide and in a test pit excavation used to facilitate the installation of SB-33 located on the river-side of the site approximately 20 feet north of the Brown's Race discharge pipe. The DNAPL was accompanied by a characteristic coal tar-like odor, and was predominantly present in the saturated zone of the overburden. Discontinuous blebs and globules of DNAPL were observed in the vicinity of former process areas such as the former Water Gas Plant, the former Tar Separator, and the former Pitch Hopper. Complete DNAPL saturation of soil (tar saturated soils) was not observed at any location on the Site.

In bedrock, traces of DNAPL in the form of a light film or discontinuous ganglia were observed in 3 of 21 borings. The observations were in limited areas on the surface of the bedrock fractures or shale partings in the upper bedrock (weathered zone).

Indications of DNAPL presence in groundwater were observed in two monitoring wells (RW-1 and GMX-MW-6S) during well development and sampling. The accumulated thicknesses were

barely measurable (less than one-half inch). The DNAPL volume was insufficient for discrete sampling or mobility assessment. Pumping of the wells during purging and groundwater sampling did not result in additional DNAPL accumulation in either well. Pumping showed that, where NAPL was present in saturated soil, it has low mobility and pumping is not an effective means of removal.

A small area of suspected gas purifier material was observed on the ground surface on the River Side of the Site in the vicinity of monitoring wells GMX-MW-17S/D. The material was composed of wood chips and fine sand and gravel, visibly blue in color with a musty odor. The suspected gas purifier material appears to be an isolated area. No other instances of suspected gas purifier materials were observed during the investigation.

1.4.3.2 Surface and Subsurface Soil

Comparison criteria for surface and subsurface soil samples used in the RI are the 6NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives (SCOs) for Restricted Use SCOs for Commercial Property and Industrial Property (December 14, 2006) and the NYSDEC Technical and Administrative Guidance Memorandum #4046 Determination of Soil Cleanup Objectives and Cleanup Levels (TAGM #4046) criteria. The TAGM #4046 criteria was included in the RI because DER-10 was not finalized until the year the RI was complete and submitted to the DEC.

Polyaromatic hydrocarbons (PAHs) were the primary potentially MGP-related chemicals detected in soil samples at concentrations above comparison criteria. Other organic chemicals, in particular benzene, toluene, ethylbenzene and xylene (BTEX) were detected far less frequently. None of the soil samples detected BTEX concentrations that exceeded Part 375 Restricted Use SCOs for commercial or industrial property.

A few metals were detected at concentrations above Part 375 Restricted Use SCOs for commercial properties, and to a lesser extent, industrial properties. Excluding supplemental samples collected in the SB-35 area and in the substation area, these included:

- 11 samples of 114 analyzed for arsenic
- 1 sample of 114 analyzed for lead
- 3 samples of 114 analyzed mercury above Part 375 Restricted Use SCOs for industrial property

Total cyanide was detected in soil at concentrations above Part 375 Restricted Use SCOs for commercial properties in just two samples collected from the central Plant area of the Site (GMX-MW18S and GMX-MW-3D) and one location east of the retaining wall on the River Side area of the site (SB-39). Total cyanide was not detected above Part 375 Restricted Use SCOs for industrial property anywhere on-site.

Collectively, these results show that the most appropriate chemical indicators of MGP-related impacts in Site soils are the PAH compounds. However, since these compounds are nearly ubiquitous in an urban environment, the presence of PAH compounds in and of itself does not necessarily indicate an MGP-derived impact. Soil sampling results conclude that soils having PAH concentrations above unrestricted use SCOs that extends to the site boundaries. Over 90% of soil samples analyzed exceeded unrestricted use SCOs for one or more PAH. No particular pattern of distribution was identified for those soils that did or did not exceed SCOs. Given the low soil cleanup objectives for some PAH compounds, it is likely that a portion of the low-level exceedances are attributable to the placement of historic fill during site construction.

PAH concentrations exceeding Part 375 Restricted Use SCOs tracked more closely with visual impact and areas of the site where MGP-related activities occurred. The mapped extent of impact is further refined to soil samples containing total PAH concentrations above 500 ppm or suspected to contain concentrations above 500 ppm based on the identification of MGP residual material at that location.

In general, the areas of the Site exhibiting physical evidence of impact and/or concentrations of PAHs above Part 375 Restricted Use SCOs for industrial property extends to the following areas of the Site:

- The central portion of the Site between Building 18, the concrete retaining wall along the River, the former diesel fuel ASTs, and the main access road to former Beebeee Station (western extent of former MGP operations);
- Three isolated areas in the southern portion of the site; and
- The River Side of the site near the former pitch hopper and the area between the former diesel oil ASTs and the north-central end of the site (east of Building 18) on the River Side of the concrete retaining wall.

The vertical extent of impact at boring/well locations is generally limited and occurs in random horizons in the overburden soil varying in depth between less than one foot below ground surface to the bedrock surface (approximately 30 feet below ground surface). However, continuous impact through the soil profile from ground surface to top of bedrock was not identified at any of the boring/well locations. DNAPL, where observed, was visible as discontinuous blebs. DNAPL-saturated soils were not identified during any of the investigations conducted at the Site.

1.4.3.3 Groundwater

Comparison criteria used in the RI to evaluate groundwater samples are the NYSDEC Ambient Water Quality Standards and Guidance in Technical and Operational Guidance Series (TOGS)

1.1.1 (June 1998) and 6 NYCRR Part 703: Surface Water and Groundwater Quality Standards and Effluent Limitations for Class GA groundwater.

Organic compounds were detected in groundwater at concentrations above New York State Class GA Groundwater Standards in overburden and bedrock groundwater monitoring wells near former MGP process areas. In the overburden:

- BTEX and PAHs were detected in overburden groundwater in the general area between Building 18 and the former diesel oil ASTs (Plant area of the Site). The detected constituent concentrations are comparatively low – total BTEX and total PAH concentrations in groundwater were below 1 ppm in all overburden wells. The comparatively low concentrations of BTEX and PAHs in groundwater suggest biological processes naturally attenuate chemical constituents present in groundwater.

- BTEX and PAHs were detected in overburden groundwater on the River Side of the Site, east of the concrete retaining wall. The RI concluded these concentrations are potentially associated with the presence of MGP residual materials (primarily TLM) observed in soils between the wall and the River and did not migrate through groundwater from source material located within the Land Side area of the Site. Based on footing elevations shown on retaining wall construction drawings, the concrete retaining wall is keyed into bedrock and serves as a barrier to the eastward movement of overburden groundwater which prevents such migration.

- Iron, manganese, and sodium concentrations were elevated compared to NYS Groundwater Standards in most overburden wells. It is not uncommon for these metals to be found at elevated concentrations in New York State groundwater which are considered to be representative of background concentrations in groundwater.

- Total cyanide was detected above the groundwater standard at two locations where either total cyanide was elevated in soil (GMX-MW-18S) or BTEX and PAHs were elevated in soil and groundwater (GMX-MW-8S).

In bedrock groundwater:

- BTEX and chloroform were the only VOCs detected above NYS Groundwater Standards in bedrock. Chloroform was not detected in soil or overburden groundwater and is not site related. Several PAH compounds were also detected in bedrock groundwater but below standards. The concentrations of BTEX and PAHs in bedrock groundwater in shallow bedrock are about an order of magnitude lower than those detected in the overburden groundwater above it.

- Well GMX-MW-6D is the exception to low constituent PAH concentrations in bedrock groundwater. Concentrations detected are likely related to the presence of DNAPL observed nearby in the overburden (corresponding to the area of the suspected foundation structure of the former primary and secondary coolers penetrated by monitoring well).

- The limit of the vertical extent of impact to bedrock groundwater from the site occurs in the Irondequoit Limestone which is immediately below the Rochester Shale. Naphthalene (17 µg/L) in well GMX-MW-6IRON is the only site-related constituent to exceed groundwater standards in the Irondequoit Formation. Site-related impacts in deeper Sodus Shale and Reynales Limestone were not identified.

- Other than metals considered to represent background concentrations, inorganic constituents, including total cyanide, were not detected in bedrock groundwater above NYS Groundwater Standards.

1.4.3.4 River Sediment

A layer of cobbles and boulders (12 to 18-inches in thickness) blankets finer-grained near- shore river sediments, except in a localized area southeast of the former CTF. Sheens on surface water were produced in four near shore areas after investigation tools penetrated the softer, finer-grained sediments existing along the entire length of the site. River sediment samples analyzed did not detect BTEX. PAHs were detected at concentrations above NYSDEC sediment criteria and total PAH concentrations were above NYSDEC Sediment Criteria in 13 of 18 samples analyzed during the RI. Laboratory forensic testing of sediment indicates that the PAHs detected are derived from both pyrogenic and petrogenic sources. Only one sediment sample was identified as being solely pyrogenic in origin. Where sheens are produced and PAHs are elevated, it is likely that those sediments are affected by MGP residuals from the site. The most frequently detected metals above sediment criteria were arsenic, copper, lead, nickel, and mercury. The concentration of metals detected in sediment samples correlate with PAH concentrations. Where PAH concentrations were higher, metals concentrations were also elevated. Total cyanide was detected in three of 18 sediment samples. NYSDEC sediment criteria do not exist for total cyanide in sediment. The Genesee River flows through downtown Rochester and drains an area of urban development and industrial use (both contemporary and historical). Point and non-point storm water flow and industrial outfall discharges have likely contributed to the chemical presence identified in sediments.

1.4.4 Human Health Exposure Assessment

The current Site use and its restricted Site access limit viable exposure scenarios. The exposure assessment focused on exposure to COPCs by:

- Current Site workers

- Current and future trespassers
- Current and future subsurface construction workers
- Hypothetical future residential users
- Adjacent off-site properties

Groundwater is not used as a source of drinking water at this Site or in the surrounding area. As a result, there is no direct exposure to COPCs in groundwater. Current Site workers can be exposed to COPCs in surface soil via incidental ingestion, dermal contact, and inhalation of particles. However, the likelihood of exposure is very low as work activities are considered passive and intrusive work activities are prohibited, resulting in little potential to disturb the areas of exposed soil. Although a potential pathway for migration of COPCs volatilizing from soil and groundwater exists, the exposure to volatile COPCs from vapor intrusion would be low. This is because low concentrations of non-chlorinated VOCs were identified in soil and overburden groundwater and exposure durations would be short since on-site buildings are used primarily for storage of equipment and supplies and are not occupied by workers on a routine basis of for long durations. Trespassers may potentially be exposed to COPCs; however, the exposure duration by a trespasser would be short given that the property is an active RG&E Facility with highly restricted access. Current and future workers involved in subsurface soil excavation (i.e., utility repair or installation) may potentially be exposed to COPCs in surface and subsurface soil. Potential exposure routes include via incidental ingestion, dermal contact, and inhalation of volatiles or soil particulates within excavation air. If future property use involved residential development (an unlikely scenario given Site surroundings but included based on current zoning which allows for residential development), exposure to COPCs was identified in surface and subsurface soil without some form of engineering and/or institutional controls. While current zoning does not prevent future residential use of the property RG&E intends to deed restrict property use to prevent potential future development of the property for future unrestricted residential use. The exposure potential of receptors on properties adjacent to the Site is extremely low since there is no potential for direct exposure (ingestion, dermal contact) or indirect exposure (inhalation of indoor air vapors) to COPCs in groundwater.

1.4.5 Fish and Wildlife Impact Analysis

The Site itself has poor resource value for wildlife as historic development of the property was for industrial use. The Genesee River is the habitat for a variety of different fish species. However, the River adjacent to the Site is not as ecologically important as it is downstream, beyond the Lower Falls, where it provides an important recreational fishery. The FWIA did not identify significant aquatic resources adjacent to the Site and analysis concluded potential adverse impacts to the aquatic community as a whole were determined to be very low. COPCs, primarily PAHs, and TLM were detected in the near shore environment in the River at some

locations along the Site. The cobbles and boulders present above finer-grain sediment poses a barrier for fish species from contacting fine-grained river sediment near the site. The presence of elevated PAH concentrations and TLM in sediment may pose a localized potential impact to the aquatic benthic community population.

2. Remedial Action Objectives

This section summarizes the COPCs established for the site and identifies the remedial action objectives.

2.1 COPCs

The potentially site-derived MGP constituents of potential concern as identified in the RI are BTEX, PAHs, and cyanide. The potential MGP-derived PAHs include:

- acenaphthene
- acenaphthylene
- anthracene
- benzo(a)anthracene
- benzo(b)anthracene
- benzo(g,h,i)perylene
- benzo(k)fluoranthene
- benzo(a)pyrene
- chrysene
- dibenzo(a,h)anthracene
- dibenzofuran indeno (1,2,3-cd) pyrene
- fluoranthene
- naphthalene
- phenanthrene
- 2-methylnaphthalene
- pyrene

2.2 Remedial Action Objectives

Remedial Action Objectives (RAOs) are identified to maintain and/or achieve conditions that are protective of public health and the environment. The RAOs developed for the site are consistent with the remedy selection process described in 6 NYCRR Part 375 and guidance presented in DER-10**.**

The RAOs are based on considerations specific to the site (e.g., detected constituents, site use, and potential exposure pathways) with consideration of the Standards, Criteria, and Guidance (SCGs) in DER-10. The RAOs developed for the site pertain to chemical presence which is attributable to the former MGP (as identified in the RI) and are presented below.

Media	RAOs for Public Health Protection	RAOs for Environmental Protection
Groundwater	▪ Prevent ingestion of groundwater with site-derived MGP contaminant levels exceeding drinking water standards. ▪ Prevent contact with, or inhalation of volatiles from, groundwater containing site-derived MGP constituents.	▪ Restore groundwater migrating from the Site to pre-disposal/pre-release/background conditions, to the extent practicable.
Soil	▪ Prevent ingestion/direct contact with contaminated soil containing site-derived MGP constituents. ▪ Prevent inhalation of (or exposure from) site-derived MGP contaminants volatilizing from contaminants in soil.	▪ Prevent off-Site migration of site-derived MGP contaminants in soils. ▪ Prevent impacts to biota from ingestion/direct contact with soil containing site-derived MGP constituents causing toxicity.
Sediment	▪ Prevent direct contact with site-derived MGP contaminated sediments.	▪ Prevent impacts to biota from ingestion/direct contact with site-derived MGP impacted sediments causing toxicity. ▪ Restore sediments to pre-release/background conditions for site-derived MGP constituents to the extent feasible.
Soil Vapor	▪ Mitigate impacts to public health (via exposure to site-derived MGP constituents) results from existing, or the potential for, soil vapor intrusion into buildings.	

3. Selected Remedial Action

The following are elements of the selected remedial action for the West Station Former MGP as described in the remedial action work plan with the incorporation of details from the Decision Document (see Appendix A):

- Institutional controls (ICs) that include: Site access restrictions (maintain site fencing); SMP identifying soil management protocols; and groundwater and land use prohibitions (incorporated into an environmental easement as appropriate)

- Removal and off-site disposal of known and accessible underground process piping associated with a source of contamination at the former MGP.

- River Side Excavation: Excavation of soil containing MGP residual material (DNAPL, Tar-Like Material {TLM} and/or purifier waste) that is identifiable visually as a distinct phase from the River Side of the Site (encompassing the soil between the river and the retaining wall and the river bank south of the retaining wall). River Side soil excavation will terminate in a northern lateral direction and at the depth where MGP residual material is not observed. Clean fill meeting requirements of 6 NYCRR Part 375-6.7(d) will replace removed soil and will include engineered materials to stabilize the retaining wall footer and include habitat restoration or the floodplain and river consistent bioengineering design principles and re-establishment of habitat function supportive of long-term viability of the barrier wall.

- Construction of near-shore water diversion structures (temporary sheet pile or other means) and excavation of visually impacted Genesee River Sediment (limits as determined by RI and PDI).

- Off-Site disposal of excavated visually and grossly impacted sediment (as defined in 6 NYCRR Part 375-1.2(u), and sediment with total PAHs above Class C criteria at a permitted facility. This would include sediment adjacent to the far northern end of the site if so determined during the PDI.

- River bed and bank bathymetry and topography will be restored with appropriate material. The design will include a monitoring plan for areas disturbed by the remedy and all activities will be consistent with requirements in 6 NYCRR Part 608.

- Pre-Design Investigation for: extent of visual impacted soil and sediment on the River Side soil excavation area, assessment of existing retaining wall integrity and repair, assessment

of soil properties along alignment of new Barrier Wall and data required to support design of near-shore water diversion structures.

- Extension of the existing site retaining wall approximately 360 feet to the south (southern terminus keyed into the intake/discharge barrier wall).

- Installation of passive DNAPL recovery wells along the upgradient (Land Side) of the retaining wall (existing and extended) to be evacuated regularly if DNAPL accumulates.

- A soil cap to include site re-grading to accommodate a 24-inch thickness of clean imported cover soil and fill meeting requirements of 6 NYCRR Part 375-6.7(d) to allow for restricted residential use of the site with placement of a demarcation layer between the site soils and the cover soils. Pavement may be used in lieu of cover soils where appropriate (e.g., roadways, driveways and parking areas).

- Implementation of a monitored natural attenuation (MNA) or enhanced MNA program to monitor the quality of groundwater migrating from the Site and/or enhance natural attenuation. Reports of attenuation will be provided at 5-year intervals will possible active remediation if natural processes alone do not address the remaining contamination.

Remediation areas to be addressed as part of the selected remedial alternative are shown on Figure 3.

4. PDI Work Scope

A Pre-Design Investigation (PDI) will be completed following Department remedy approval. This section describes field studies, field and testing methods, and investigation activity that will provide supplemental information required for detailed design. The PDI work scope has been segregated into work tasks occurring on the "River Side" of the Site (east of the concrete retaining wall and/or in the Genesee River channel) and those occurring on the "Land Side" of the Site (west of the concrete retaining wall, on the elevated portion of the Site.) PDI work tasks will include the following:

River Side Investigation:

- Construction of River Side access;
- Existing retaining wall integrity assessment;
- Visual and chemical characterization of River Side soils and near-shore sediments at the North end of Site; and,
- Physical characterization of near shore river sediments.

Land Side Investigation:

- Non-intrusive geophysical mapping along alignment of new retaining wall and decommissioned intake/outflow structure; and,
- Geotechnical soil borings, rock coring and test pit investigation for new retaining wall construction.

The following subsections describe each PDI activity which will be conducted in accordance with the HASP and CAMP described in Section 5.0 of this Work Plan.

4.1 River Side Investigation

All PDI work tasks occurring as part of the River Side Investigation will be coordinated with the RG&E Hydro group which includes following RG&E River Communication Protocol, which is outlined in the Health and Safety Plan for the PDI, provided as Appendix B. RG&E will temporarily lower the surface water elevation of the River between the court Street dam (High Falls Area and Station 5 (Middle Falls area) to facilitate the daily investigation activities. The scope of work for the River Side investigation is provided in the following sections.

4.1.1 Task 1 - River Side Access and Work Area Improvements

The River Side of the existing retaining wall is heavily vegetated with trees and small shrubs thereby limiting access by personnel and equipment. It will be necessary to locally clear

vegetation in the proposed investigation areas to make a clear and safe working area to complete the integrity assessment of the wall. At each proposed test pit location adjacent to the existing barrier wall (Figure 4), existing vegetation will be removed to clear an area large enough for a mini-excavator to be inserted into the River bed. A crane will be utilized to lower the excavator over the edge of the retaining wall, so special precautions will be made to clear any tree limbs or vegetation which overhang the investigation areas. Vegetation cleared from the investigation areas will be transported to the Land Side of the Site where it will be chipped and subsequently removed from Site. In preparation for the test pit excavations, the excavator will be used to level the ground surface in each area of investigation, as necessary.

River sediment test pit transect #4, located at the south end of the Site, is situated in an area of the river bed which may require additional improvements to gain suitable access with the drilling/excavating equipment. The near-shore river bed conditions near Transect #4 will be evaluated the first day the river level is lowered and the need for access improvements will be assessed at that time. If necessary, the contractor will be prepared to supply up to 40 tons of crushed stone and/or Mabey-style crane matting to establish a temporary equipment access ramp into the river bed at this location. Upon completion of the PDI, the crane matting will be removed from the river bed, and the crushed stone added to the river bank will be removed from the bank and staged neatly on-Site for future use as grading material if visually uncontaminated subject to Department approval. Visually contaminated materials will be containerized for proper off-site disposal.

Personnel access to the river bed at the North end of the Site will be accomplished through rehabilitation/reconstruction of the existing timber stairway previously utilized for personnel access during RI field activities. The condition of the staircase will be evaluated by the remedial contractor and repaired as necessary to provide safe, temporary access for the PDI.

4.1.2 Task 2- Test Pit Excavations and Retaining Wall Visual Assessment

The selected remedial action includes excavation of soils adjacent to the existing retaining wall. The condition of the existing retaining wall barrier will be verified to evaluate precautionary or stabilization measures to be taken during remedial excavation (to avoid damaging the structure) and to identify repairs which may be necessary (if any) prior to backfilling with clean soil during remedial construction. The predesign investigation will expose the bedrock surface along the River Side of the wall near locations where DNAPL has been observed (near wells GMX-MW-19S and GMX-MW-25S) in order to inspect the base of the wall and the bedrock surface for signs of DNAPL seepage. The construction of the base of the wall and the bedrock/wall interface will be visually inspected on the River Side. The existing retaining wall assessment will consist of the following elements:

- Lowering of excavation equipment to the River Side of the retaining wall;

- Excavation to expose the wall footer and bedrock surface;
- Placement of a trench box in excavation and necessary dewatering equipment, if needed, and visual assessment of wall integrity;
- Concrete coring and extraction with testing of concrete cores collected from the wall; and
- Test pit backfilling of material in reverse order of excavation.

Methodology: Following access and work area improvements, three test pits will be excavated along the existing retaining wall in areas that historically exhibited NAPL presence (Figure 4). The test pit/ wall assessment work will be conducted under a low river-level condition which will be coordinated with RG&E. Test pits will be excavated at the toe of the wall on the River Side, and will be perpendicular from the face of the wall (west to east). Each test pit will extend through the fill material to refusal at the bedrock surface. Test pits will be logged on appropriate field forms which document the location, orientation and physical dimensions of each test pit. Descriptions of soil/fill type, groundwater conditions and any NAPL presence will be presented on the logs. The wall and exposed areas will be examined by a structural engineer and hydrogeologist to assess: 1. wall construction and integrity; 2. ascertain conditions for load pressure distribution calculations needed for design of the River Side soil excavation; and 3. The wall's effectiveness as a barrier to potential DNAPL transport. If groundwater accumulates in the excavation prohibiting visual inspection of the lower portion of the retaining wall, accumulated groundwater will be pumped using a 4-inch Godwin pump, and re-directed to a silt bag staged adjacent to the test pit area. The silt bag will be staged on poly sheeting with sorbent boom and silt fence or hay bales placed around the perimeter of the discharge area to protect adjacent surface water beyond the immediate work zone. Inspection for visible sheen beyond the boom system will occur daily when in-water work is being performed.

If gross contamination is encountered during the test pit program (separate phase NAPL, stained soil or purifier waste), the test pit will be immediately backfilled and an alternative nearby test pit location will be selected. Each test pit will be photographed to document the fill properties and the condition and construction of the wall.

Each test pit will be backfilled to surrounding grade at the completion of the assessment. Backfilling of the excavation will occur in place of soil in reverse order of removal. Crushed stone will be placed on top of the backfilled test pit.

Concrete Testing: Concrete cores will be drilled through the existing retaining wall. At each of three locations, a pair of concrete cores will be collected. Three cores locations will be selected near the top of the wall, and three near the bottom two-thirds of the wall. Each core will extend through the entire width of the wall or a maximum of 3 feet in length. The core will be tested for UCS by the following method(s):

- ASTM D7012 on in-tact samples
- ASTM D5731(point load) may be used for additional data on core fragments.

UCS data obtained from concrete core analysis will be used to evaluate the integrity of the wall and the need (if any) to repair the wall during remedial excavation of the River Side soils.

4.1.3 Task 3 - North End River Side Soil Characterization

GEI correspondence dated August 29, 2016 submitted on behalf of RG&E agreed to examine soil north of GMX-MW-19S for tar-like material, DNAPL, and purifier waste (between the retaining wall and the River's edge at the northern end of the site). Findings from the characterization will support the detailed remedial design which will define the extent of River Side soil excavation at the north end of the site. The north end soil investigation procedure is described below.

Three test pits will be excavated at approximately 100 ft. intervals between GMX-MW-19S and the northern property boundary using an excavator. Clearing of trees and vegetation may be necessary to gain access to the north end soils. If necessary, tree and vegetation clearing will be performed as described in Section 4.2.1 above. The approximate locations of the test pits are shown on Figure 4. The final location of each test pit in the north end will be determined in the field based on surface conditions and physical access with the excavator. Each test pit excavation will be advanced to refusal or to the maximum reach of the mini-excavator (estimated to be no less than 8 ft.), whichever occurs first. At each test pit location, one (1) surface soil sample (0-2" bgs) and one deeper soil sample (collected between 2 and 4 feet bgs) will be collected using sampling procedures consistent with those presented in the 2008 Remedial Investigation Field Sampling Plan. Soil samples will be collected directly from the excavator bucket using dedicated stainless-steel sampling equipment and placed in laboratory-provided sample containers. Samples will be couriered under chain-of-custody procedures to TestAmerica Laboratory in Amherst, New York. Samples will be analyzed for TCL VOCs, TCL SVOCs and total metals including cyanide. Analytical results will be evaluated according to CP-51 policy.

Test pits will be logged on appropriate field forms which document the location, orientation and physical dimensions of each test pit. Descriptions of soil/fill type, groundwater conditions and any TLM, NAPL or purifier material presence will be presented on the logs. Each test pit will be backfilled following sample collection and documentation. After backfilling, the location of each test pit will be staked and labeled in the field for survey by a licensed NYS Surveyor.

4.1.4 Task 4 – River Sediment Characterization- Sediment Removal Area

Surface water diversion during near shore sediment removal will require design of a temporary surface water flow barrier to be constructed in the Genesee River. An investigation will be

performed to determine the extent of boulder and cobble-size materials in the river, the sediment thickness and the depth to bedrock. The sediment characterization effort will include the excavation of test pits and/or soil borings to determine depth to bedrock and sediment type directly overlying bedrock.

Additional stream bed sediment characterization will be performed using sampling techniques outlined in the *National Engineering Handbook Part 654- Technical Supplement 13A; Guidelines for Sampling Bed Material*, provided as Appendix C.

Sediment characterization activities in the River bed will be coordinated with RG&E's Hydro Group, NYS Canal Corporation and other involved agencies, and will be performed when the River level is lowered. The anticipated surface water elevations to which the Genesee River would need to be lowered to for this work were detailed in a memorandum that GEI submitted to RG&E dated April 4, 2017. The memo, provided as Appendix D, presented GEI 2009 River bathymetry data adjacent to the Site and outlined the necessary River elevations to perform the sediment characterization effort. The River sediment characterization work encompasses an area adjacent to the Site from the south at an elevation of 390 (+/-) Feet Mean Sea Level (fasl) to an elevation to the north of 386 (+/-) fasl (Appendix D Figure 2). Lowering the surface water elevation of the River to 1 to 2 feet below these elevations would facilitate the collection of higher quality river sediment characterization data to support structural designs for sediment removal.

River sediment characterization may be performed by a single or two concurrent crews consisting of three to four working personnel using a mini-excavator and/or a track-mounted drill rig equipped with augers. The ideal work hours when the river level would be required to remain low would be from approximately 7am and 4pm, daily during a 3 to 4-day period. Three test pit transects will be completed at locations shown on Figures 4 and 5. At each transect location, three N-S oriented test pits will be completed to determine sediment type, thickness and depth to bedrock. At each transect, individual transect locations will be selected to investigate the full extents of the sediment removal area. Test pits and/or soil borings will be advanced through the sediment to refusal at the bedrock surface. Each test pit will be backfilled with excavated materials at the completion of the investigation.

4.1.5 Task 5 – North End River Sediment Characterization

Additional characterization of near shore sediments will be performed directly offshore of the north end of the Site and will focus on delineating the extent of impacted sediments through visual assessment and laboratory analysis. At each of three locations shown on Figure 4, an excavator will be utilized to advance a shallow test pit to the bottom of the boulder/cobble zone (approximately 1.5 feet in thickness). The soft, fine-grained sediment below will be visually characterized with respect to grain size and the presence of any visual or olfactory evidence of

impact, including NAPL, tar, sheens or odors. Three analytical samples will be collected from the north end sediment test pits using methods consistent with the RI Work Plan and submitted for laboratory analysis for TCL VOCs, TCL SVOCs and total metals (including cyanide). Analytical results will be compared to sediment guidance values (SGVs) in NYSDEC Screening and Assessment of Contaminated Sediment (June 24, 2014).

In addition to the above-described analyses, three representative sediment samples will be transmitted to META Environmental laboratories for detailed forensic analysis. The forensic analysis will include the following analyses:

- MAH/PAH compounds (EPA Method 8100)
- Extended PAH profiles (EPA Method 8270mod)

The forensic analysis will serve as a fingerprint for organic compounds detected in the North end sediment samples to infer pyrogenic vs. petrogenic origin of PAH constituents and aid in the determination of site-related or urban storm water discharge-derived PAH compounds in River sediments.

Field observations will be documented on sampling logs. Each sampling location will be backfilled with the excavated material at the completion of the characterization. The results of the north end sediment characterization will aid the design engineer in determining the need for sediment removal, if any, beyond the limits of the sediment removal area established in the selected remedy (Figure 3).

4.2 Land Side Investigation

4.2.1 New Barrier Wall Area Background

Extension of the existing site retaining wall will be designed to extend approximately 360 feet in a south and southwest direction with its southern terminus keyed into the decommissioned (concrete-filled) former Beebe Station discharge tunnel structure (Figure 6). Based on historical Site drawings and field observations, alignment of the new barrier wall passes through an area of the Site that was historically occupied by several above-ground and subsurface structures, foundations and utilities. Most above-ground structures have been removed in this area; however, remnant foundations and concrete pads/footers are present adjacent to the river bed and on the Land Side ground surface. Additionally, historic Site drawings indicate the presence of MGP-related utilities, buried foundations (related to the former above ground fuel oil storage tanks and Water Gas Plant) and a chimney stack along the proposed alignment. The approximate locations of these historic foundations are provided on Figure 2. Historic drawings detailing the design of the Brown's Race Outfall, the former AST foundations and the chimney stack foundation are presented in Appendix E. Utilities and historic foundations/ structures present

along the new barrier wall alignment will impact design and construction planning and it is therefore necessary to investigate the area along the wall alignment to gain sufficient information about the subsurface to support design of the barrier wall extension. A geophysical survey (ground penetrating radar and electromagnetic (EM-61) surveys), soil borings, bedrock cores and test pits will be completed along the alignment of the new barrier wall between the southern terminus of the Existing Barrier Wall and the former Beebe Station concrete intake structure. Characterization data will be used to determine soil/fill and upper bedrock conditions along the new wall alignment and how subsurface foundations/ structures will impact wall design. New Barrier Wall alignment investigation techniques are described in the following sections.

4.2.2 Task 1- Historic Utility Review / Geophysical Survey

Utility identification in prior investigations at the Site consisted of the mark-out required by law and geophysical surveys around RI locations to confirm the required mark-outs and to investigate the presence of other subsurface infrastructure. Therefore, utilities or other subsurface infrastructure will be identified as part of the PDI Scope. Identification of potential utilities/infrastructure will consist of the following:

- Review of historic utility drawings which were summarized during the 2008 RI Work Plan and are presented in Appendix F;
- A utility mark-out to obtain information regarding active utilities at and surrounding the Site will be used to evaluate impacts to proposed or potential remediation activities; and,
- Ground penetrating radar and electromagnetic (EM-61) geophysical surveys to confirm public utility mark-outs, compare with historic Site plans and investigate the presence of other underground infrastructure or foundations to safely guide the subsequent test pit and soil boring efforts.

4.2.3 Task 2- Exploratory Test Pit Excavations

Exploratory test pits will be completed along the proposed New Barrier Wall alignment to identify the potential presence of buried utilities/infrastructure identified during the historic Site drawing review and to investigate anomalies identified during the geophysical investigation. The location of test pits along the New Barrier Wall alignment will be determined in the field based on the results of the Site plan review of historical structures and geophysical survey. Test pits will be completed to a depth of approximately 12 feet below ground surface using a track-mounted excavator to investigate the presence of foundations in this area. Efforts will be made to establish the thickness and orientation of each foundation. Test pits will be logged on appropriate field forms which document the location, orientation and physical dimensions of the test pit. Descriptions of soil/fill type, groundwater conditions and the presence of utilities, foundations or infrastructure will be likewise documented on the field forms in plan and cross-

sectional view. Photographs of each test pit will be taken to visually document soil properties and the presence of buried utilities or foundations and will be presented with the test pit logs. The location of each test pit and the location of utilities and/or foundations encountered along the alignment investigation will be surveyed by a NYS licensed Surveyor prior to backfilling of each test pit. Each test pit will be backfilled to surrounding grade in the reverse order of excavation and recompacted in 2-foot lifts whenever possible.

4.2.4 Task 3- Existing Soil Boring and Bedrock Core Data Review

Overburden lithology and geotechnical data are available along portions of the New Barrier Wall alignment from soil borings and bedrock cores completed during the 2006 oil-tar separator investigation are presented in Appendix G. It is anticipated that existing bedrock cores completed during previous investigations will be made available by RG&E for review and subsequent geotechnical testing by GEI. A data review of existing soil boring and bedrock coring logs will be completed to determine if any data gaps exist along the proposed wall alignment. Where data gaps exist, information gathered from the utility review, geophysical testing and test pit excavations will be used to guide the installation of additional soil borings along the alignment of the New Barrier Wall. Boring locations will be selected in the field such that each boring does not intersect buried utilities or foundations and where a complete cross section of overburden and bedrock materials can be investigated. It is anticipated that up to two (2) additional soil borings and bedrock cores will be completed along the New Barrier Wall Alignment to supplement existing information. Soil boring and bedrock coring and testing procedures are described below.

4.2.5 Task 4- New Wall Alignment Soil Borings and Bedrock Coring

At each soil boring location, continuous soil samples will be collected with a 2-inch diameter stainless steel split spoon ahead of 4-1/4-inch hollow stem augers. Soil/ fill materials will be logged by a qualified hydrogeologist/engineer in accordance with the Unified Soil Classification System (USCS) on appropriate field logs. Standard Penetration Test (SPT) values will be recorded for each 2-foot sample. Each soil boring will be advanced to sampler refusal at the bedrock surface. If bedrock is not encountered in a boring (i.e., auger refusal is met on a foundation or within fill) the boring will be offset and re-advanced. Following sampler refusal, the augers will be advanced to a depth of approximately 1-foot into the bedrock surface to form a temporary rock-socket seal ahead of bedrock coring. At each new boring location, HQ rotary coring methods will be used with potable water to retrieve a 5-foot section of bedrock core. Description of the core, including the Rock Quality Designation (RQD) will be completed as described in the FSP from the RI. Investigation-derived-waste (IDW) generated during the soil boring process will be containerized in steel 55-gallon drums, properly labeled and stored neatly on Site. A Materials Management Plan, presented in Section 6.0 describes storage and disposal of IDW generated during the PDI.

4.2.6 Task 5- Rock Core Testing

Samples of bedrock core from previous investigations and the newly completed PDI bedrock cores will be selected for testing for Unconfined Compressive Strength (UCS) by the following methods:

- ASTM D7012 on in-tact samples
- ASTM D5731(point load) may be used for additional data on core fragments.

UCS data from bedrock cores will be used to support the design of the New Barrier Wall.

4.3 Survey

The location of each PDI sample location (test pits, soil borings, soil/sediment samples) will be surveyed by a New York State-licensed surveyor. Additionally, the locations of foundations, utilities or other subsurface infrastructure encountered during the new barrier wall alignment investigation will be surveyed to aid in the development of the detailed remedial design. Survey points from the PDI will be incorporated into CAD-format Site drawings and provided with the final report.

5. Site Health and Safety Plan with Community Air Monitoring

A Site-specific Health and Safety Plan (HASP) is included in Appendix B. The HASP will apply to PDI and remedial construction-related work on-site. The HASP provides a mechanism for establishing on-site safe working conditions, project safety organization, procedures, and personal protective equipment requirements. The HASP meets the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65). Appendix E of the HASP includes a Community Air Monitoring Plan (CAMP) for protection of the public during intrusive construction activity. The CAMP was prepared in accordance with the guidelines provided in the New York State Department of Health (NYSDOH) Generic CAMP and Occupational Safety and Health Administration (OSHA) standards for construction (29 CFR 1926). Continuous monitoring on the perimeter of the work zones for odor, VOCs, and dust will be required for ground intrusive and soil handling activities. Air monitoring stations will be established to monitor upwind and downwind Site perimeters. Each station will include a photoionization detector (PID) and a DustTrak aerosol monitor or equivalent. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil sampling. Action levels for the protection of the community and visitors are set forth in the CAMP. Action levels for site worker respiratory use will also be set forth in the HASP.

6. Decontamination and Management of Investigation-Derived Waste

Decontamination of equipment (drill rig, excavation equipment, tooling etc.) will consist of physically removing residual contaminated soil from the equipment using steam cleaning/pressure washing methods. A temporary decontamination pad consisting of poly sheeting surrounded by 2 x 6 boards will be constructed on-Site at a location central to work activities. The boards and sheeting will be oriented such that a temporary wash basin is created suitable to collect decontamination water. Drill rig tooling and equipment buckets will be placed in/over the pad and washed with pressurized steam until clean. If equipment or tooling exhibits staining from NAPL, it may be necessary to utilize a degreasing agent (e.g. "Simple Green") to facilitate cleaning. Decontamination fluids will be collected from the pad and transferred into DOT-approved 55-gallon drums for subsequent characterization and disposal.

Larger pieces of equipment requiring decontamination/cleaning will be parked on larger sections of polyethylene sheeting and brushed/washed until cleaned. The larger sheets will be subsequently rolled up to containerize soil/sediment and placed in 55-gallon drums for disposal.

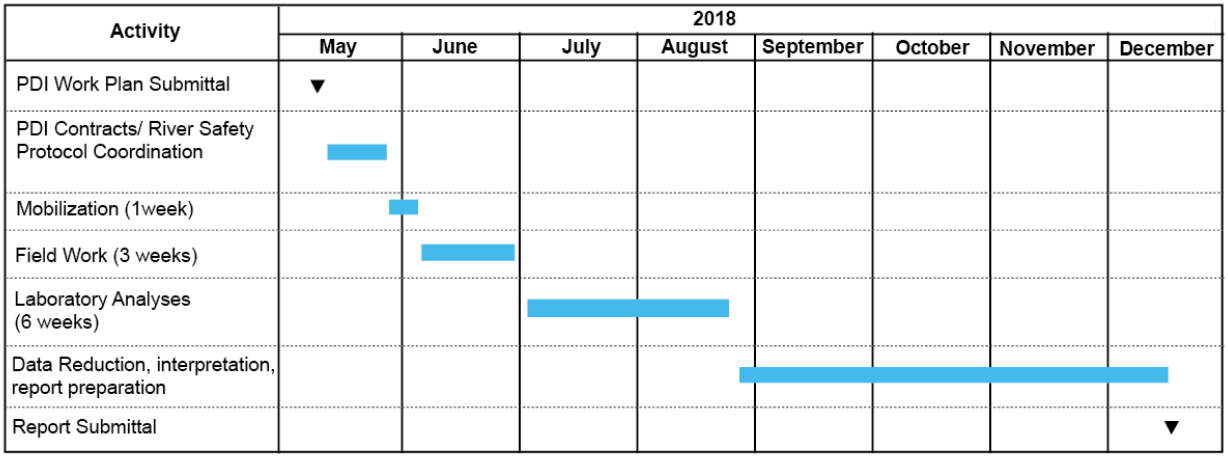
IDW generated during the PDI will be appropriately containerized in roll-off containers or 55-gallon drums as described above. Containers will be appropriately labeled with the contents, location, and date and staged on-Site at a location selected by RG&E. Container contents will be sampled and analyzed for disposal characterization and transported off-site for disposal at an approved facility.

7. Pre-Design Investigation Report

Information gathered from the PDI activities will be summarized in a report with certification by a NYS-licensed Professional Engineer. The report will include a description of work activities and deviations from the work plan, a summary of findings with tables and figures, boring/test pit/photographic logs, laboratory testing data and survey data. The report will be submitted to the NYSDEC in both hard copy and in digital format on CD. The digital document shall be in PDF form. Laboratory analytical data will be submitted in an electronic data deliverable (EDD) format that complies with the NYSDEC's electronic data warehouse standards.

8. Schedule

A proposed schedule for the pre-design investigation process is provided below. It is critical that the work is performed under low surface water conditions. RG&E has planned a future river level control to lower river levels between the Upper and Middle Falls to accommodate work on a tainter gate above the Middle Falls. This should allow lower water levels in the river adjacent to West Station to safely collect the pre-design investigation data in and adjacent to the river.



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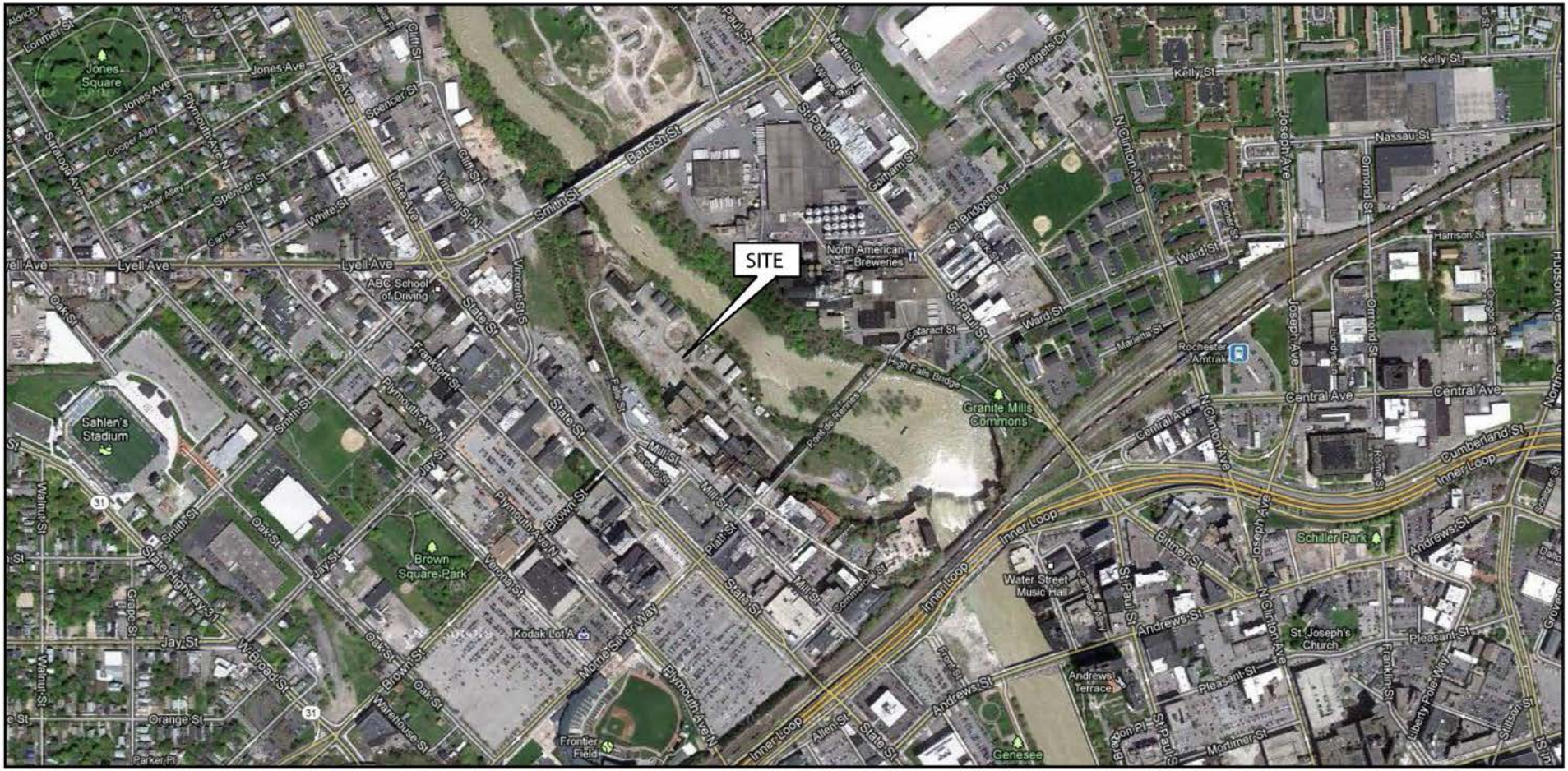
TABLES

Table 1
PDI Sampling Summary
RGE West Station Former MGP Plant Area PDI
Rochester, New York

Sample Type	Analysis	Sample Analysis Method	Approximate Number of Samples
Surface Soil Samples	TCL VOCs, TCL SVOCs, TAL metals +CN	EPA 8260, EPA 8270, EPA 6010B, EPA 9010	3
Subsurface Soil Samples	TCL VOCs, TCL SVOCs, TAL metals +CN	EPA 8260, EPA 8270, EPA 6010B, EPA 9010	3
North End Sediment Samples	TCL VOCs, TCL SVOCs, TAL metals +CN	EPA 8260, EPA 8270, EPA 6010B, EPA 9010,	3
	Forensics	EPA 8100, EPA 8270mod	
Retaining Wall Concrete Core Samples	UCS [(1)]	ASTM D7012 [(2)]	6
Bedrock Core Samples	UCS	ASTM D7012	5

Notes
[(1)] UCS- Unconfined Compressive Strength
[(2)] ASTM 5731 may be used on core fragments, where applicable.

FIGURES

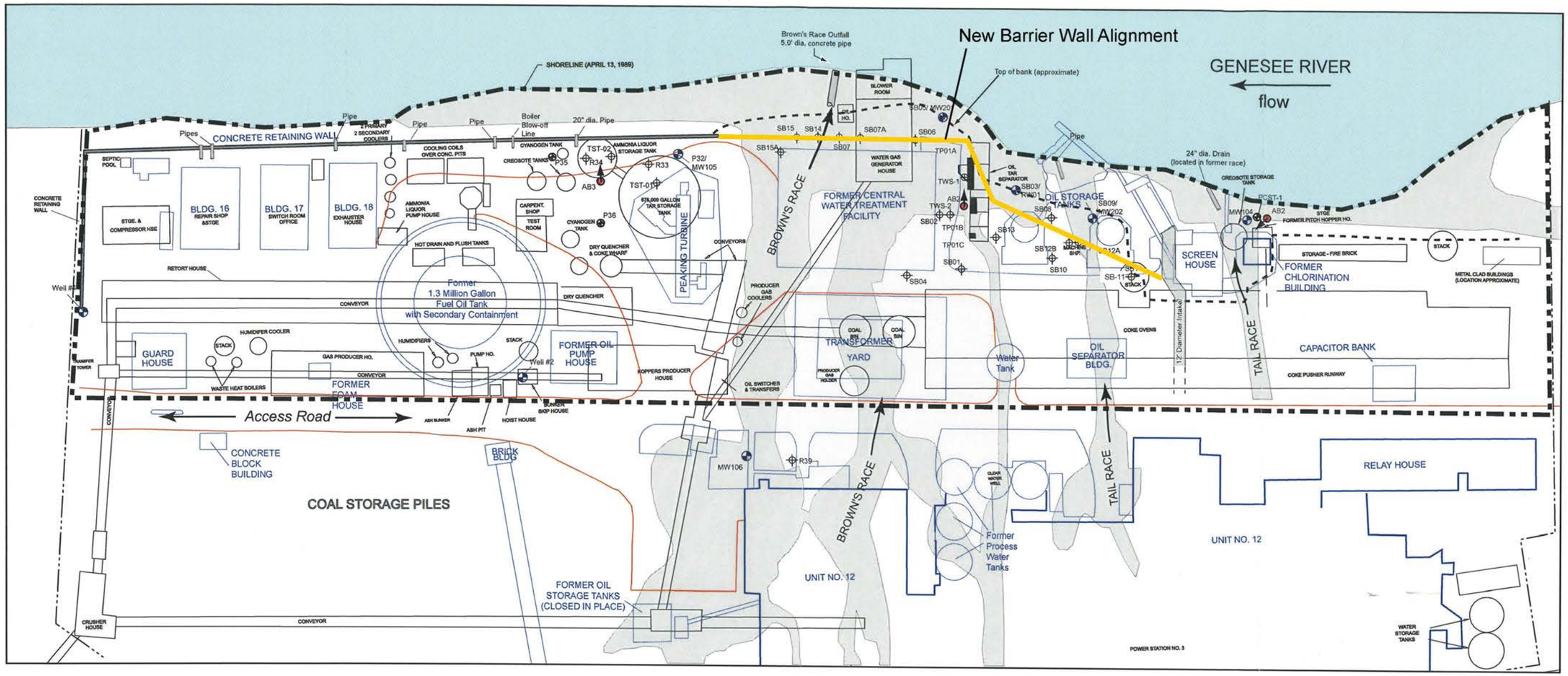


0 1.0 2.0

SCALE
(miles, approximate)

SITE LOCATION MAP
Rochester Gas and Electric
West Station Former MGP Plant Area PDI
Rochester, New York

By: MAC	Date: Sept. 2017	Project No. 128480
GEI Consultants		Figure 1



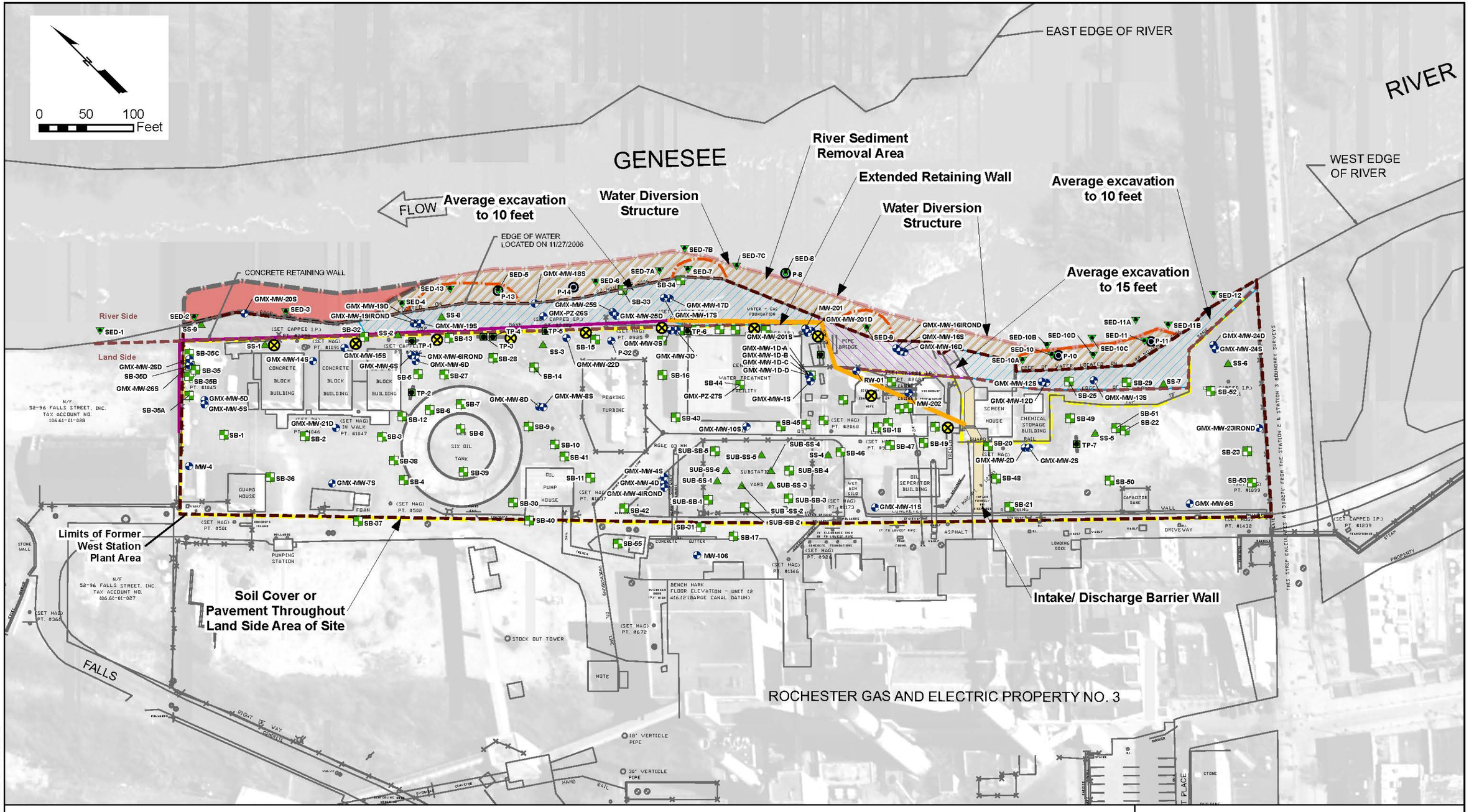
LEGEND

- Historic Tail Race Infilled During Property Development
- Limits of Ashphalt
- Property Line (approximate)
- Soil Boring and Surbusrface Soil Sample Location
- Monitoring Well Location
- Angle Boring Location with Direction of Boring
- Existing Site Structure (December 2006) Within Footprint of Former MGP
- Historic or Former Site Structure (approximate location)
- Existing Closed Beebee Station Electric Power Generation Plant
- Limits of Former West Station Plant Area
- Proposed Extension of Existing Retaining Wall
- River Sediment Removal Area

0 80 160 Feet

Historic Site Features and
Pre-RI Sampling Locations
West Station Former MGP Plant Area PDI
Rochester, New York

By: MC	Date: Sept. 2017	Project No. 128480
GEI Consultants		Figure 2



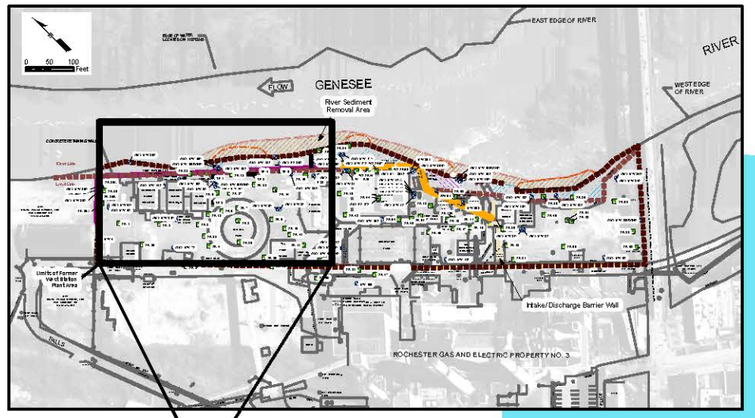
Explanation

- Monitoring Well
- Pore Water
- Sediment Sample
- Soil Boring
- Surface Soil
- Test Pit
- Passive DNAPL recovery well
- Extension of existing barrier wall
- Extent of sediment impacts (RI)
- River sediment removal area
- Average excavation to 10 feet
- Average excavation to 15 feet
- Intake/ Discharge Barrier Wall
- Extent of Cover System (1-2 ft soil or pavement)
- River sediment removal area (contingent on PDI results)

SITE REMEDY WITH RI SAMPLING LOCATIONS
Rochester Gas and Electric
West Station Former MGP Plant Area PDI
Rochester, New York

By: MC	Date: Sept. 2017	Project No. 128480
GEI Consultants		Figure 3

S:\BU\BU12116090\13_0102_aar_fig_23.mxd



Enlarged Area

Previous Investigation Sampling Locations

- 2008 RI Soil Boring
- Previous Investigation Soil Boring
- Monitoring Well

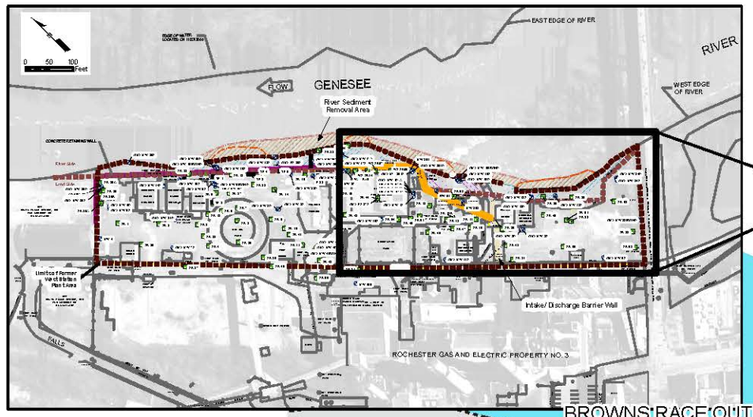
Explanation

- Existing Concrete Retaining Wall
- Extension of Existing Retaining Wall
- River Sediment Removal Area
- PDI Test Pit Location
- River Sediment Characterization Location
- River sediment removal area (contingent on PDI results)

0 25 50 Feet

PDI Investigation Locations- North Plant Area
Rochester Gas and Electric
West Station Former MGP Plant Area PDI
Rochester, New York

By: MC	Date: Sept. 2017	Project No. 128480
GEI Consultants	Figure	4



Enlarged Area

RIVER SEDIMENT TEST PIT TRANSECT #3

BROWNS RACE OUTFALL (5' DIA. CONCRETE PIPE)

GENESEE RIVER

SOFT SEDIMENT INVESTIGATION AREA

RIVER SEDIMENT TEST PIT TRANSECT #4

SEDIMENT REMOVAL AREA

SB-34
GMX-MW-17S
GMX-MW-17D
WS-SB06
WS-SB07A
WS-SB05/MW-201
GMX-MW-201D
GMX-MW-16IROND
GMX-MW-16S
GMX-MW-16D
GMX-MW-201S
WS-SB03/RW-01
GMX-MW-3S
GMX-MW-3D
WS-SB07
WS-SB14
WS-SB15
GMX-MW-1D-A
GMX-MW-1D-B
GMX-MW-1D-C
GMX-MW-1D-D
WS-SB02
WS-SB08
WS-SB09/MW-202
GMX-MW-24D
GMX-MW-24S
CONCRETE RETAINING WALL
SB-16
SB-44
GMX-PZ-27S
WS-SB13
GMX-MW-1S
WS-SB12B
WS-SB12B
GMX-MW-12S
GMX-MW-12D
SB-25
GMX-MW-13S
SB-29
SB-52
WS-SB01
WS-SB10
WS-SB11
SB-18
SB-43
WS-SB04
SB-45
GMX-MW-10S
SB-49
SB-51
SB-22
GMX-MW-23IROND
SB-47
SB-19
SB-20
GMX-MW-2D
GMX-MW-2S
SB-46
SB-23
SB-48
SB-50
SB-53
SB-21
GMX-MW-11S
GMX-MW-9S
NORTH PLANT AREA
SOUTH PLANT AREA
SUBSTATION YARD
OIL SEPERATOR BUILDING
WET ASH SILO
SCREEN HOUSE
CHEMICAL STORAGE BUILDING
CAPACITOR BANK
INTAKE TUNNEL/ 001 DISCHARGE
WATER TREATMENT FACILITY
CENTRAL
WATER
EDGE OF WATER LOCATED 28 NOV
TOP OF BANK
TOP OF WALL
RAIL
GUARD
TRENCH
STAIRWAY
CONCRETE
RETAINING WALL
BOLLARDS
GATE
WATER SPICKET
DISCHARGE
OIL TAR SEPARATOR
SECONDARY CONTAINMENT
CASING
3 MH
D.I.
(SET MAG) PT. #1173
(SET MAG) PT. #2160
(SET MAG) PT. #1220
(SET MAG) PT. #1099
(SET CAPPED I.P.) PT. #2083
(SET CAPPED I.P.) PT. #2085
(SET CAPPED I.P.) PT. #2084
(SET CAPPED I.P.) PT. #2031

Explanation

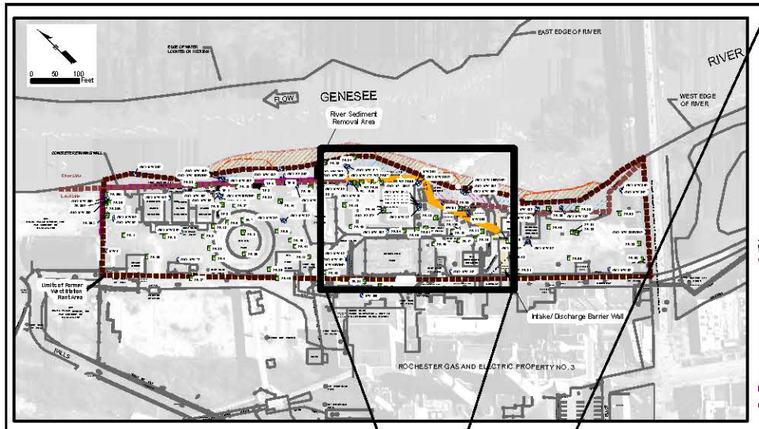
Previous Investigation Sampling Locations
- 2008 RI Soil Boring
- Previous Investigation Soil Boring
- Monitoring Well

- Existing Concrete Retaining Wall
- Extension of Existing Retaining Wall
- River Sediment Removal Area
- PDI Test Pit Location

0 25 50 Feet

PDI Investigation Locations- South Plant Area
Rochester Gas and Electric
West Station Former MGP Plant Area PDI
Rochester, New York

By: MC	Date: Sept. 2017	Project No. 128480
GEI Consultants		Figure 5



Enlarged Area

GENESEE RIVER

BROWNS RACE OUTFALL (5' DIA. CONCRETE PIPE)

FORMER WATER GAS PLANT FOUNDATION (CONCRETE)

NEW BARRIER WALL ALIGNMENT

FORMER OIL ASTs

FORMER STACK LOCATION

SB-34
SB-33
GMX-MW-17S
GMX-MW-17D
GMX-MW-25S
GMX-MW-25D
WS-SB14
OIL HO.
WS-SB06
WS-SB05/MW-201
GMX-MW-201D
GMX-MW-16IROND
GMX-MW-16S
GMX-MW-16D
(SET MAG) PT. #925
GMX-MW-3S
WS-SB07
WS-SB07A
GMX-MW-201S
WS-SB03/RW-01
OIL TAR SEPARATOR
GMX-MW-3D
WS-SB15
GMX-MW-1D-A
GMX-MW-1D-B
GMX-MW-1D-C
GMX-MW-1D-D
WS-SB02
CENTRAL
WATER TREATMENT FACILITY
SB-16
SB-44
GMX-PZ-27S
GMX-MW-1S
WS-SB08
24" CASING
SECONDARY CONTAINMENT MOTE
WS-SB09/ MW-202
WS-SB12B
WS-SB13
WS-SB07
WS-SB10
WS-SB12A
SB-43
WS-SB04
GMX-MW-10S
WS-SB01
SB-45
SB-18
WS-SB11
STACK
SCREEN HOUSE
RG&E 03 MH
SB-47
SB-19
GUARD
TRENCH
SB-46
BEEBEE STATION CONCRETE INTAKE/ DISCHARGE STRUCTURE
UNDERGROUND LINE
GMX-MW-4S
GMX-MW-4D
GMX-MW-4IROND
ASPHALT SIDEWALK
003 DISCHARGE
SUBSTATION YARD
WET ASH SILO
BUILDING
002 DISCH.
INTAKE TUNNEL/ 001 DISCHARGE
(SET MAG) PT. #1173
GMX-MW-11S
CONCRETE
SB-42
BARRIERS
D.I.
GATE
WATER SPICKET
BOLLARDS
STAIRWAY
VAULT
SB-31
17' TO LOWEST PIPE
ASPHALT
16' CLEARANCE SIGN
20' TO LOWEST PIPE
CONCRETE GUTTER
SB-17
SB-55
CONCRETE FOUNDATIONS
CONC. FOUND.
M.H.
VAULT

Explanation

Previous Investigation Sampling Locations
- 2008 RI Soil Boring
- Previous Investigation Soil Boring
- Monitoring Well

PDI Investigation Locations
- Soil Boring and Bedrock Core Location
- Geophysical investigation Area (approximate)

Extension of existing barrier wall

0 25 50 Feet

NEW BARRIER WALL INVESTIGATION AREA
Rochester Gas and Electric
West Station Former MGP Plant Area PDI
Rochester, New York

By: MC	Date: Sept. 2017	Project No. 128480
GEI Consultants	Figure	6

Appendix A

NYSDEC Decision Document

DECISION DOCUMENT

RGE - West Station
Voluntary Cleanup Program
Rochester, Monroe County
Site No. V00593
February 2018

Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

DECLARATION STATEMENT - DECISION DOCUMENT

RGE - West Station
Voluntary Cleanup Program
Rochester, Monroe County
Site No. V00593
February 2018

Statement of Purpose and Basis

This document presents the remedy for the RGE - West Station site, a voluntary cleanup site. The remedial program was chosen in accordance with the New York State Environmental Conservation Law and applicable guidance.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (the Department) for the RGE - West Station site and the public's input to the proposed remedy presented by the Department.

Description of Selected Remedy

The elements of the remedy are as follows:

1. Remedial Design
2.

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows;

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. Excavation

Excavation and off-site disposal of contaminant source areas from the shoreline of the site (encompassing the soil between the river and the retaining wall, and from the river bank south of the retaining wall) including:

- grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
- soil containing visual impacts including tar like material, purifier waste, or non-aqueous phase liquid;
- soil containing total SVOCs exceeding 500 ppm;
- soils that create a nuisance condition, as defined in Commissioner Policy CP-51 Section G.

Excavation and removal of any underground storage tanks (USTs), fuel dispensers, underground piping or other structures associated with a source of contamination. Approximately 11,300 cubic yards of contaminated soil will be removed from the site. The approximate depth of excavation will be between 6 and 15 feet (bedrock). Excavation will terminate at the depth where MGP source material is not observed. Clean fill meeting the requirements of 6 NYCRR Part 375-6.7(d) will be brought in to replace the excavated soil or complete the backfilling of the excavation and establish the designed grades at the site. Habitat restoration of the floodplain and stream consistent with bioengineering design principles and re-establishment of habitat function.

3. Cover System

A site cover will be required to allow for restricted-residential use of the site in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). Where a soil cover is to be used it will be a minimum of two feet of soil placed over a demarcation layer, with the upper six inches of soil of sufficient quality to maintain a vegetative layer. Soil cover material, including any fill material brought to the site, will meet the SCOs for cover material for the use of the site as set forth in 6 NYCRR Part 375-6.7(d). Substitution of other materials and components may be allowed where such components already exist or are a component of the tangible property to be placed as part of site redevelopment. Such components may include, but are not necessarily limited to: pavement, cement, paved surface parking areas, sidewalks, building foundations and building slabs. The cover system within the bank and floodplain will consist solely of soil and will not include a demarcation layer, and shall be placed in accordance with Element 5 below.

4. Sediment Removal

Excavation and off-site disposal of near-shore, visually impacted sediment from the Genesee River (encompassing all sediment adjacent to the site). Sediment will be removed based on the following criteria:

- grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
- sediment containing visual impacts including tar like material, purifier waste, or non-aqueous phase liquid;
- sediment with total PAH concentrations exceeding Class C criteria

Sediment will be accessed through the construction of a near-shore water diversion structure such

as temporary sheet piling or other means. Approximately 8,000 to 10,000 cubic yards of contaminated sediment will be removed from the site. The final extent of sediment excavation will be determined following a pre-design investigation. Excavation criteria will be confirmed based on visual inspection.

5. Restoration of Sediment Removal Area

Stream bed and bank bathymetry and topography will be restored with appropriate material. The stream bed, banks and floodplain will be restored in-kind to the extent possible using natural stream restoration design principles and with the goal of re-establishing habitat function. Bank and floodplain restoration will not supersede the current or extended barrier wall described in Element 6. If present, submerged aquatic vegetation in the remediation area will also be restored. The design will include a monitoring plan for areas disturbed by the remedy and all activities will be consistent with the requirements of 6 NYCRR Part 608.

6. Barrier Wall

The existing site retaining wall will be extended approximately 360 feet to the south to form a barrier wall to contain remaining on-site contamination. The southern terminus of the barrier wall will be keyed into the decommissioned house inlet structure. The barrier wall will be designed to prevent dense non-aqueous phase liquid (DNAPL) from seeping through the wall towards the river bank and Genesee River. The barrier wall will extend to bedrock. A pre-design investigation of the existing retaining wall will be conducted, and repairs will be made as necessary.

7. DNAPL Recovery

Installation and operation of DNAPL recovery wells along the upland side of the barrier wall to remove potentially mobile DNAPL from the subsurface. The number, depth, type and spacing of the recovery wells will be determined during the design phase of the remedy. DNAPL will be collected periodically from each well; however, if wells are determined by the Department to accumulate large quantities of DNAPL over extended time periods, they can be converted to automated collection.

8. Monitored Natural Attenuation

Groundwater contamination (remaining after active remediation) will be addressed with monitored natural attenuation (MNA). Groundwater will be monitored for site related contamination and also for MNA indicators which will provide an understanding of the (biological activity) breaking down the contamination. It is anticipated that contamination will attenuate over a 30-year time period. Reports of the attenuation will be provided at 5 year intervals, and active remediation will be proposed if it appears that natural processes alone will not address the contamination. The contingency remedial action will depend on the information collected, but it is currently anticipated that in-situ biological treatment would be the expected contingency remedial action.

9. Institutional Controls

Imposition of an institutional control in the form of an environmental easement for the controlled property which will:

- 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 restricted residential, commercial or industrial use 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; and
- require compliance with the Department approved Site Management Plan.

10. Site Management Plan

A Site Management Plan is required, which includes the following:

1. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
Institutional Controls: The environmental easement discussed in paragraph 8 above.
Engineering Controls: The soil cover discussed in Paragraph 3, the barrier wall discussed in Paragraph 5, and the DNAPL recovery system discussed in Paragraph 7.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
- a provision should redevelopment occur to ensure no soil exceeding protection of groundwater concentrations will remain below storm water retention basin or infiltration structures.
- descriptions of the provisions of the environmental easement including any land use, and groundwater use restrictions;
- a provision for evaluation of the potential for soil vapor intrusion for any occupied buildings built in the future on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- a provision that should a building foundation or building slab be removed in the future, a cover system consistent with that described in Paragraph 3 above will be placed in any areas where the upper two feet of exposed surface soil exceed the applicable soil cleanup objectives (SCOs)
- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

2. a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

- monitoring of groundwater to assess the performance and effectiveness of the remedy;
- a schedule of monitoring and frequency of submittals to the Department;
- monitoring for vapor intrusion for any occupied existing or future buildings on the site, as may be required by the Institutional and Engineering Control Plan discussed above;
- Monitoring of the barrier wall effectiveness in preventing contaminant release to the river; and
- Monitoring of the restored river bank and river bed for erosion with repairs, as needed.

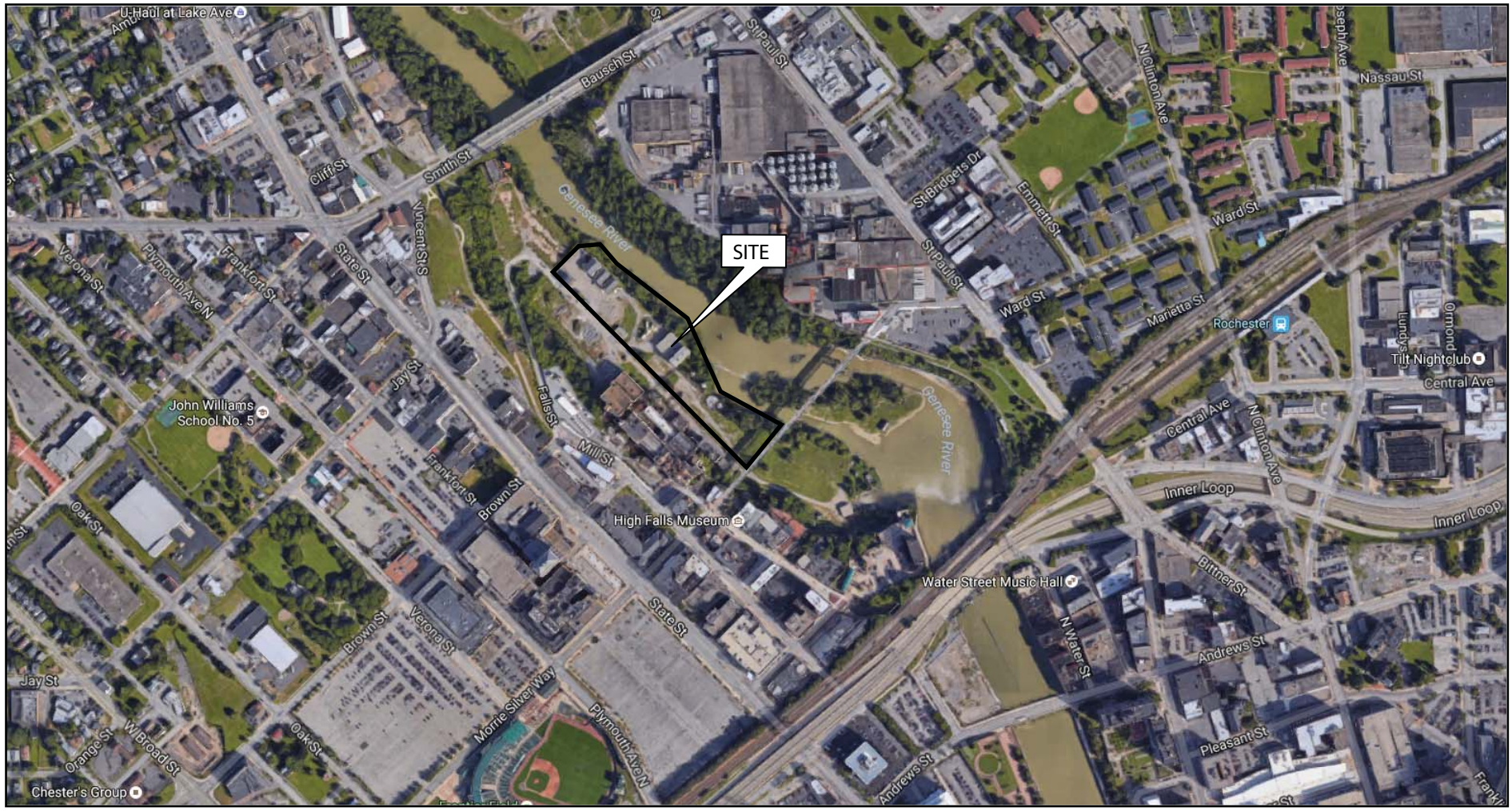
3. an Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, optimization, monitoring, inspection, and reporting of any mechanical or physical components of the remedy (DNAPL recovery). The plan includes, but is not limited to:
- procedures for operating and maintaining the remedy;
- compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
- maintaining site access controls and Department notification; and
- providing the Department access to the site and O&M records.

Declaration

The remedy conforms with promulgated standards and criteria that are directly applicable, or that are relevant and appropriate and takes into consideration Department guidance, as appropriate. The remedy is protective of public health and the environment.

February 20, 2018
Date

George Heitzman, Director
Remedial Bureau C



New York State

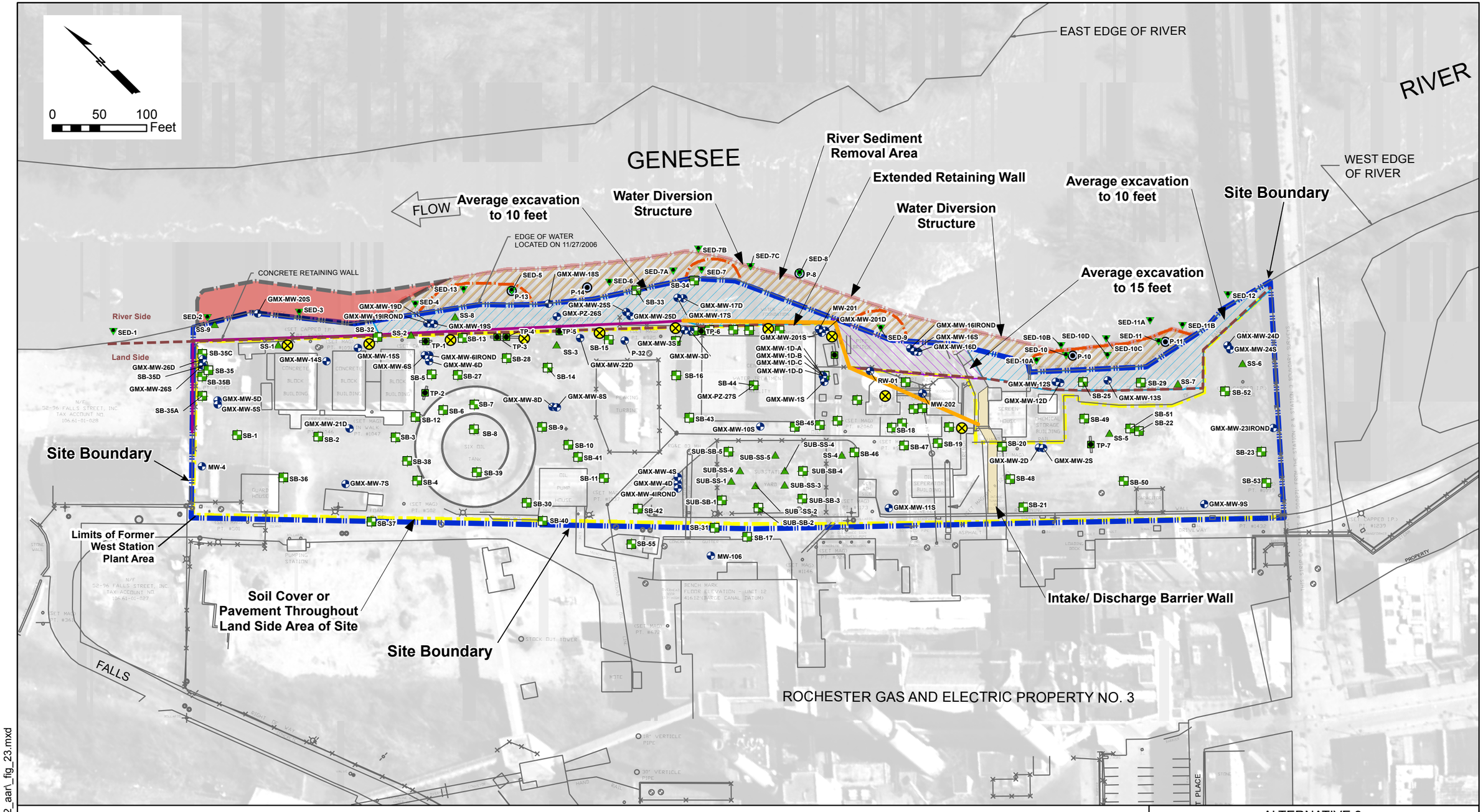
0 1.0 2.0

SCALE
(miles, approximate)

N

SITE LOCATION MAP
Rochester Gas and Electric
West Station Former MGP Plant Area
Remedial Action Work Plan
Rochester, New York

By: MAC	Date: 10/2016	Project No.128480
GEI Consultants		Figure 1



Explanation

- Monitoring Well
- Pore Water
- Sediment Sample
- Soil Boring
- Surface Soil
- Test Pit
- Site Boundary
- Extension of existing barrier wall
- Extent of sediment impacts (RI)
- Passive DNAPL recovery well
- River sediment removal area
- Average excavation to 10 feet
- Average excavation to 15 feet
- Intake/ Discharge Barrier Wall
- Extent of Cover System (1-2 ft soil or pavement)
- River sediment removal area (contingent on PDI results)

ALTERNATIVE 3:
EXTEND EXISTING BARRIER WALL, DNAPL RECOVERY, SOIL COVER
Rochester Gas and Electric
West Station Former MGP Plant Area RAWP
Rochester, New York

By: MC	Date: October 2017	Project No. 128480
GEI Consultants	Figure	2

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Appendix B

Health and Safety Plan (including Community Air Monitoring Plan)

(Provided under Separate Cover)

Geotechnical
Environmental
Water Resources
Ecological

Health and Safety Plan and Community Air Monitoring

RG&E West Station Plant Area
Rochester, New York
Site No. V00593-8
Index No. B-0535-98-07

Prepared For:
Rochester Gas and Electric
Rochester, New York

Submitted by:
GEI Consultants, Inc., P.C.
90B John Muir Drive Suite 104
Amherst, New York 14228
May 2018

Project No. 128480

Richard H. Frappa, P.G.
Project Manager

Steven Hawkins, CSP
Regional Health and Safety Officer

Table of Contents

Tables

Appendices

1. Emergency Contact Information

Table 1. Emergency Information

Important Phone Numbers		Directions to Hospital
Local Police:	911	To Hospital and Occupational Health Clinic: See Attached Maps and Directions in Appendix A
Fire Department:	911	
Ambulance:	911	
State Police or County Sheriff:	911	
Strong Memorial Hospital 601 Elmwood Ave Rochester, NY 14642	(585) 275-9555	**Strong Memorial Hospital** (3.6 mi – about 13 min.) Start at foot of Falls Street 1. Head south on Falls St. Toward Brown St. (440 ft) 2. Take For St. and Mot Hope Ave to Crittenden Blvd (3.3 mi) 3. Continue on Crittenden Blvd to destination End at 601 Elmwood Ave Rochester, NY 14642
OnSite Occupational Health Services 400 Air Park Dr. #90 Rochester, NY 14624	(585) 235-3890	**OnSite Occupational Health Services:** (6.8 mi – about 10 min.) Start at foot of Falls Street 1. Head south on Falls St. Toward Brown St. (440 ft) 2. Turn right on Brown Street and Merge onto I-490 West (0.7 mi) 3. Continue on I-490 West to I-390 S (5.4 mi) 4. Take Exit 17 and merge onto NY-383 South/ Scottsville Rd. (0.2 mi). 5. Continue on NY-383 South/ Scottsville Rd. (0.5 mi.) 6. Turn left on Airpark Dr. (440 ft). Destination will be on the left. End at 400 Air Park Dr. #90 Rochester, NY 14624
Project Manager: Michael Cummings- GEI	716-204-7155 office 716-572-4362 cell	
Corporate Health and Safety Officer : Steve Hawkins	(860) 368-5348 office (860) 916-4167 cell	
Client Contact: Christopher Keipper	(585) 771-4560 office (585) 363-3204 cell	
Nearest Telephone Location: On-site cellular		

2. Background Information

2.1 General

Engineer GEI Consultant, Inc. P.C.

Project Name RG&E West Station Plant Area
Rochester, New York

This Health and Safety Plan (HASP) establishes policies and procedures to protect personnel from the potential hazards posed by the activities at the RG&E West Station Plant Area (Site). Reading of the HASP is required of on-site personnel and will be reviewed by subcontractors. Subcontractors will prepare their own Site-specific HASP and may use this as a guide. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions. 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 encountered 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 specifies Community Air Monitoring requirements.

2.2 Site Description

The West Station Site is a former MGP located at 254 Mill Street in Rochester, Monroe County, New York (Figure 1). The Site is presently owned by RG&E and is bounded by RG&E Power Station No. 3 (Beebe Station electric generation plant) situated on Mill Street and Falls Street to the west, the former City of Rochester trash incinerator plant to the north, the Genesee River to the east, and the Platt Street Bridge on the south. The area of the Site south of the Platt Street Bridge was called the “Park Area” of the West Station Site (which was remediated by RG&E in accordance with VCA Index No. D8-0001-95-10), while the remaining portion of the West Station Site was referred to as the “Plant Area”. The former MGP processes were located on the Plant Area portion of the Site and encompass approximately 7 acres. For the purposes of defining areas of the Site targeted for characterization and remediation, the Plant Area is discussed in terms of “land side” and “river side” which are separated by a concrete barrier wall in the northern portions of the property and by buildings/structures and a stone wall at the southern end of the property.

The Site is relatively flat, with an average ground elevation of approximately 412 feet above mean sea level (feet msl). Several buildings and structures owned by RG&E remain on the property.

2.3 Project Description

The Remedial Action (RA) for the West Station Plant Area will initially consist of a pre-design effort, which will include:

- characterization of soil and sediments on the Genesee River side of the Site;
- limited excavation of soils adjacent to the existing concrete retaining wall to assess its integrity, and;
- exploratory soil borings completed along the alignment of a new concrete barrier wall to be constructed during the implementation of the remedy.

Information derived from pre-design information will be used to guide the implementation of the remedy which will include;

- excavation, stabilization/dewatering and disposal of Genesee River sediments and River-Side soils;
- Removal of former processing piping associated with the former MGP;
- Excavation and disposal of Land-Side soils;
- Construction of a new concrete barrier wall which will tie into the existing concrete barrier wall;
- Installation of DNAPL recovery wells, and;
- Placement of a 24” thick cover soil across the Site.

3. Statement of Safety and Health Policy

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 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.

4. Hazard/Risk Analysis

Physical hazards associated with drilling, excavation, and construction may be present. These activities would require the use of heavy equipment by subcontractors such as drill rigs and excavators during excavation and characterization activities. Potential hazards include, but are not limited to, the following:

- bodily injuries
- slipping, tripping or falling
- falling into water (drowning)
- heavy lifting
- being struck by machinery or falling objects

The 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 remedial action work is started. In each case, any utility company that is involved should be notified in advance by the Remediation Contractor, and its approval or services, if necessary, will be obtained.

Smoking is prohibited at the facility per RG&E requirements.

4.1 Personal Safety

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

- www.cityrating.com/crimestatistics.asp: Crime in Rochester, NY is significantly above both the New York State and National averages

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 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 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.

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.

General Hazards These Hazards Apply to All Site Activities	Control Measure
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)
Driving	• Employees must wear their safety belt while in a moving vehicle. • Vehicle accidents will be reported. • Vehicles will be properly maintained and safely operated. • 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	• Avoid travel at extreme times • Wear protective gear – dust masks, safety glasses

General Hazards These Hazards Apply to All Site Activities	Control Measure
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
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

General Hazards These Hazards Apply to All Site Activities	Control Measure
Noise	• Maintain distance from the source of the noise. • Wear appropriate hearing protection when working in load environments.
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.
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.
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.

General Hazards These Hazards Apply to All Site Activities	Control Measure
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
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.

Activity	Potential Hazard	Control Measures
Boating/Barge/ Near Shore Work	Drowning, fall hazards, pinch points, hypothermia	• Use caution when boarding the boat/barge. • Establish a safe area for boarding and de-boarding. • Do not stand in the boat. Avoid sudden movements. • Stay away from the edge of the boat/barge. • Wear a PDF at all times when on the water. • Have an extra set of clothing in case of drenching/soaking to prevent hypothermia. • See SOP HS-017

Activity	Potential Hazard	Control Measures
Construction Site Entry	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.
Dense Non-Aqueous Phase Liquid (DNAPL) Gauging and Recovery	Contaminant Exposure, Repetition, Slips/Trips/Falls	• Wear proper PPE during sampling including Tyvek or Tyvek apron with sleeves, Nitrile gloves, and face shield/safety glasses. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.
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.
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.

Activity	Potential Hazard	Control Measures
Excavation and Trenching Oversight	Crushing, entrapment, falls	• 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/ DNAPL 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.
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.
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.

Activity	Potential Hazard	Control Measures
Mobile Equipment Use	Falls, crushing	• Inspect equipment prior to use. • Use equipment in accordance with manufacturer's specifications and instructions. • Wear appropriate PPE including: hard hat, gloves, steel toed/shank safety boots, safety glasses and high visibility reflective clothing. • Unauthorized personnel will not be permitted to ride on equipment unless it is equipped to accommodate passengers safely. • The operator will make sure the warning signal is operating when the equipment is backing up. • Wear seat belts and adjust them for a proper fit. • See SOP HS-021
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.
Waste Characterization	Contaminant Contact 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.
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

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 and the Project Manager.

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 Electrical Hazards

4.2.2.1 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.

4.2.2.2 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.

The location of utilities will be discussed with 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.

4.2.2.3 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.

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 staff. The competent person must also have the authorization to take prompt corrective measures to eliminate unsatisfactory conditions.

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 <One-Call/Dig-Safe> center 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 field staff, 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 the Excavation Safety SOP for further information.

4.2.4 Fire and Explosion

The use of a boat engine, drill rig, and tools that are gasoline powered presents the possibility of fire and explosion hazards. Underground/underwater utility lines also present fire and explosion hazards. Prior to the start of any work, all underground utilities and piping that may pose a potential hazard will be identified and located. The One Call center (Dig Safely, NY) will be called and underground utilities will be located and marked. In the event a pipe or line is struck, work will stop and the emergency response plan will be implemented.

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 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.

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.

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 (GFCI)-equipped circuits will be used for power tools.

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. Field 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 and demolition equipment. Field 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 and away from your body; pulling motions are easier to manage.
- Do not put the knife in your pocket.
- Wear leather or Kevlar® gloves when using knives or blades, or when removing sharp objects caught or dangling in sampling gear.

4.2.13 Working with Ladders and on Scaffolding

Field staff may be required to use ladders or scaffolding to access equipment of work areas. SOPs for working with ladders (SOP No. HS-011) and scaffolding (SOP No. HS-019) should be followed. The SOPs should be reviewed in the project planning stage and at the project execution stage.

For each project/task the proper ladder needs to be selected. Prior to each use, a ladder needs to be inspected and used in accordance with 29 CFR 1926.1053, as applicable. Copies of the standards will be kept on file.

If work on scaffolding is required, it will be performed in accordance with 29 CFR 1926.451, as applicable. Copies of the standards will be kept in the project file. Work on scaffolds will not be performed without first notifying and receiving approval from the CHSO. A competent person should supervise the erection, modification, and disassembly of scaffolds.

4.2.14 Working Near Water

River levels will be lowered and controlled by the RG&E Hydro operations group during work activity on the River Side of the site. With the lower river levels, work activity will allow work to be performed along the retaining wall and on the cobble layers of the river bed to occur without entry of staff into river water. As a result, this section, "working near water" is applicable because staff will not be working in river 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 work zone will be established using caution tape to prevent workers from direct entry into moving water. A throwable rescue device (Type IV personal flotation device [PFD] flotation aid) equipped with a 90-foot nylon safety line will be available to recover an individual from the water in an emergency.

There could be a situation where the river channel has a deeper section and a rescue skiff could be functional and not bottom out and foul on the river bed. Therefore, a rescue skiff will be present during work on the River Side of the site. The rescue skiff will be equipped with a small motor and oars and will be located near the edge of moving water on the downstream side of the work area. The skiff will be of appropriate size capable of being quickly launched by one person.

GEI will designate one team member to monitor work activity when work occurs with 10-feet of the edge of moving water. In an emergency, the designated person will toss the PFD on the downstream side of the individual. The skiff will be launched only if primary and secondary safety measures fail. The designated person will never be more than 20-feet from the PFD and rescue skiff during work activity. The designated person will be in communication with appropriate RG&E Hydro group operations staff during all work activity occurring on the River Side of the site.

Waders may not be worn when working near moving waters. However, waders maybe worn to access non-moving pools and where water depths are below the waist, if bottom conditions are firm and well understood. Waders must never be worn aboard a watercraft.

Personnel should take special care on slippery rocks along the riverbanks. 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 or implement engineering controls to overcome the hazards.

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 (VOC)

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 Semi-Volatile Organic Compounds (SVOC)

Semi-volatile organic compounds (SVOCs) usually 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, and pyrene.

These 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.
These compounds are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. SVOCs 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. Many SVOCs are considered to be very toxic, if ingested. High levels of exposure to SVOCs, 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.

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 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)fluoranthene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphthalene, 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.

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.

4.3.4 Heavy Metals

The Site may contain elevated levels of metals including arsenic, copper, iron, manganese, mercury, selenium, 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 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.

No adverse health effects are associated with environmental exposure to iron. Target organs for iron via ingestion of iron (most often in supplement form) are the liver, cardiovascular system, and kidneys. Exposure to high concentrations of iron through ingestion can cause salivation nausea, vomiting, diarrhea, and abdominal pain.

Exposure to high concentrations of manganese can cause manganism, metal fume fever, flulike fever, and kidney 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 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 VOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

4.3.5 Cyanide

Cyanide compounds are common by-products of manufactured gas production. Hydrogen cyanide is toxic because it is a chemical asphyxiate. It replaces the oxygen in the blood and cyanide ion is bound too tightly to the iron and cannot therefore replace the oxygen. It takes a great amount of heat and/or acid to release cyanide gas from the ferro cyanide molecule; therefore, hydrogen cyanide is not a concern at this Site.

4.3.6 Hydrogen Sulfide

Hydrogen sulfide is another common by-product of manufactured gas production. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and 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.

4.3.7 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. A Community Air Monitoring Plan (CAMP) which describes air quality monitoring for receptors at the Site perimeter (outside the work zone) is provided as Appendix D.

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.

4.3.8 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.

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/m^3	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: 12º F IP: 9.24 eve LEL: 1.2% UEL:7.8% VP: 75 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
Iron	1309-37-1	Iron oxide dust and fume: (Fe_2O_3) as FE: 5mg/m^3 (TWA)	Iron oxide dust and fume: 10mg/m^3	Inhalation, ingestion, eye contact	Respiratory tract irritation, coughing, shortness of breath, overdose of iron may cause vomiting, abdominal pain, bloody diarrhea, vomiting blood, lethargy, and shock; acidity in the blood, bluish skin discoloration, fever, liver damage, and possibly death; eye and cornea irritation and discoloration.	Eyes, respiratory system, GI tract, liver	Reddish brown solid FP; NA LEL: NA UEL: NA VP: 0 mmHg

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m^3	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
Manganese	7439-96-5	TWA 1 mg/m ST 3 mg/m^3	C 5 mg/m^3	Inhalation, ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; lowback pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	Respiratory system, central nervous system, blood, kidneys	A lustrous, brittle, silvery solid. FP: NA LEL: NA UEL: Na VP: 0 mmHg
Naphthalene	91-20-3	10 ppm (52 mg/m^3) TWA, 15 ppm (79 mg/m^3) STEL	10 ppm (50 mg/m^3) TWA	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	FP: 174 F IP: 8.12 eV, LEL: 0.8% UEL:6.7%, VP: 0.08 mm
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: 40^o F IP: 8.82 eV LEL: 1.1% UEL:7.1% VP: 21 mm

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
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: 90° F LEL: 0.9% UEL: 6.7% VP: 9 mm
Zinc	1314-13-2	5 mg/m^3 (TWA), 10 mg/m^3 (STEL) for zinc oxide fume	10 mg/m^3 (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
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
IP = Ionization Potential
LEL = Lower explosive limit
mg/m^3 = micrograms per cubic meter
min = minute
mm = millimeter
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

Table 3. Chemical Data

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

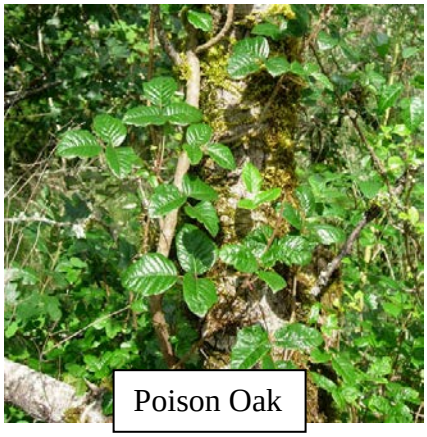
H2S = Hydrogen Sulfide
HCN = Hydrogen Cyanide
hr = hour
STEL = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure approximately 68°F in mm Hg

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, 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 CHSO 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, 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. 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 an employee is allergic to bees or wasps notify the SSO and if, needed, the location of the epi pen.

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.

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).

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			
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
Remedial Investigation/Construction			
Drilling, Well Installation, Excavation, Digging Test Pits, Backfilling, Grading, Construction, Observation, 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	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)
Remediation Observation/Documentation			
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	D - None

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.

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, modified 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 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.

6. Key Project Personnel/Responsibilities and Lines of Authority

6.1 Project Personnel

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

6.1.1 Project Manager

The PM 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;
- Verifying that the 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 to work on this program have completed environmental, health and safety requirements and has been deemed acceptable for the proposed scope of work; and
- Coordinating the activities of subcontractors and confirming that they are aware of the pertinent health and safety requirements for this project.

6.1.2 Corporate Health and Safety Officer

The CHSO, 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 Site Safety Officer

Field staff are responsible for implementing the safety requirements specified in this HASP. However, one person 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 RG &E 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 field staff;
- Verifying that PPE and health and safety equipment 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 Field Personnel

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.

6.2 Engineers, Contractors, and Subcontractors

Engineers, contractors, and 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.

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.

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.

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 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. Personnel that have not received project-specific training will not be allowed on-site.

7.5 On-Site Safety Briefings

On-site personnel will be given health and safety briefings daily by the remediation contractor SSO or field representative to assist personnel in safely conducting work activities. The briefing will include and 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. The meetings will also be an opportunity to periodically update the employees on monitoring results.

7.6 First Aid and CPR

The PM will verify that 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. employees also attend annual Bloodborne Pathogens training in compliance with OSHA regulations.

8. Medical Surveillance Program

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 must be developed prior to working at the site. The CHSO and is responsible for the administration and coordination of medical evaluations. Comprehensive examinations are given tofield 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.

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 PM or SSO prior to the start of field activities.

9. Monitoring

9.1 Air 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. Community air monitoring for the Site and Site perimeter is addressed in the Community Air Monitoring Plan supplied as an appendix to this HASP. Work requiring air monitoring includes the installation and/or abandonment of monitoring wells, DNAPL recovery wells and the excavation or manipulation of Site soil and/or sediment.

Activities requiring air monitoring will be conducted in accordance with a pre-approved work plan. If Action Levels are exceeded, the SSO will immediately implement Site action(s) according to Table 6 below and notify the PM and CHSO.

At a minimum, the following equipment is required for health and safety monitoring of on-site personnel:

- PID with 10.6 eV lamp or equivalent;
- 5-gas meter with sensors to monitor for O^2, H_2S, HCN, LEL, and CO;
- Dust 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.

Dust meters will be used to measure airborne particulate matter in the work zone 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.

The perimeter and work zone air monitoring will be conducted during all intrusive 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.

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 detector tube for benzene or zNose® 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 or zNose® 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.

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

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 to provide assistance in the event of an emergency. A copy of this plan will be given to any person acting as a "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 work 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.

11. Accident Reporting

Incidents involving 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 must be reported. The report will be made to the PM **verbally** as soon as possible, **but no later than 2 hours** of the incident. The PM will **immediately** inform the CHSO, the Director of Human Resources, and a Project-Specific RG&E Representative **any accident, incident, injury or near miss.** An Accident Report form will be submitted within **12 hours of the incident**. Staff must be aware that addressing accidents and injuries takes precedence over completing field work. If a staff member requires medical attention, or an incident/accident has occurred that call this into question, work must stop and the situation must be addressed.

12. Decontamination Procedures

A decontamination pad will be established for personnel decontamination and equipment decontamination.

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 personnel or subcontractor personnel wearing PPE from Level D through Level C.

- ***Step 1 –*** Equipment drop (respirator, tools, monitoring equipment, etc.) Decontaminate as appropriate.
- ***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.

12.2 Heavy Equipment Decontamination

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 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.

13. Supplemental Contingency Plan Procedures

13.1 Hazard Communication Plan

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.

13.2 Fire

In the event of a fire personnel will evacuate the area. The owner's 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 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. 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 personnel and subcontractor personnel from the Site will be the responsibility of the engineer. Notification of evacuation will be made to the PM and the CHSO. The field representative will account for engineer 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.

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.

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.

14. RG&E-Specific Required Protocols

RG&E requires that contractors performing work on construction-type projects on RG&E premises to conform to specific policies and requirements outlined in the document entitled "Contractor Safety Requirements". The document outlines general rules and procedures specific to RG&E Site operations which may not otherwise be covered by this HASP. RG&E-specific protocols will be included with final design documents.

15. Health and Safety Plan Sign-Off

Field 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: RG&E West Station Plant Area

Investigation: Remedial Activities

Project No: TBD

Print Name	Signature
Project Manager:	

Appendix A

Map to Hospital and Occupational Health Clinic

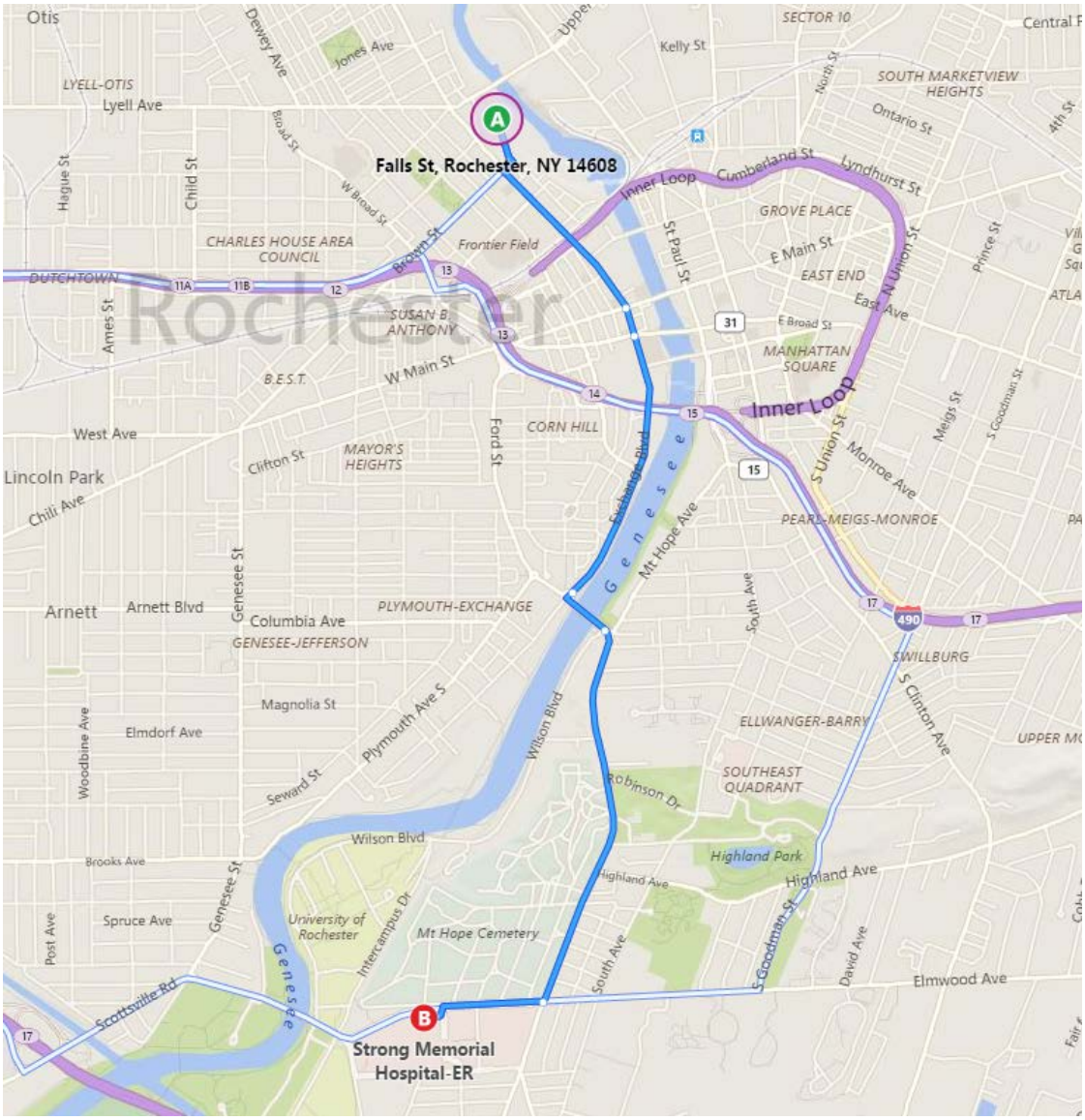
Directions from West Station to Strong Memorial Hospital ER.

(3.6 mi – about 13 min.)

Start at foot of Falls Street

1. Head south on Falls St. Toward Brown St. (440 ft)
2. Take For St. and Mot Hope Ave to Crittenden Blvd (3.3 mi)
3. Continue on Crittenden Blvd to destination

End at 601 Elmwood Ave
Rochester, NY 14642



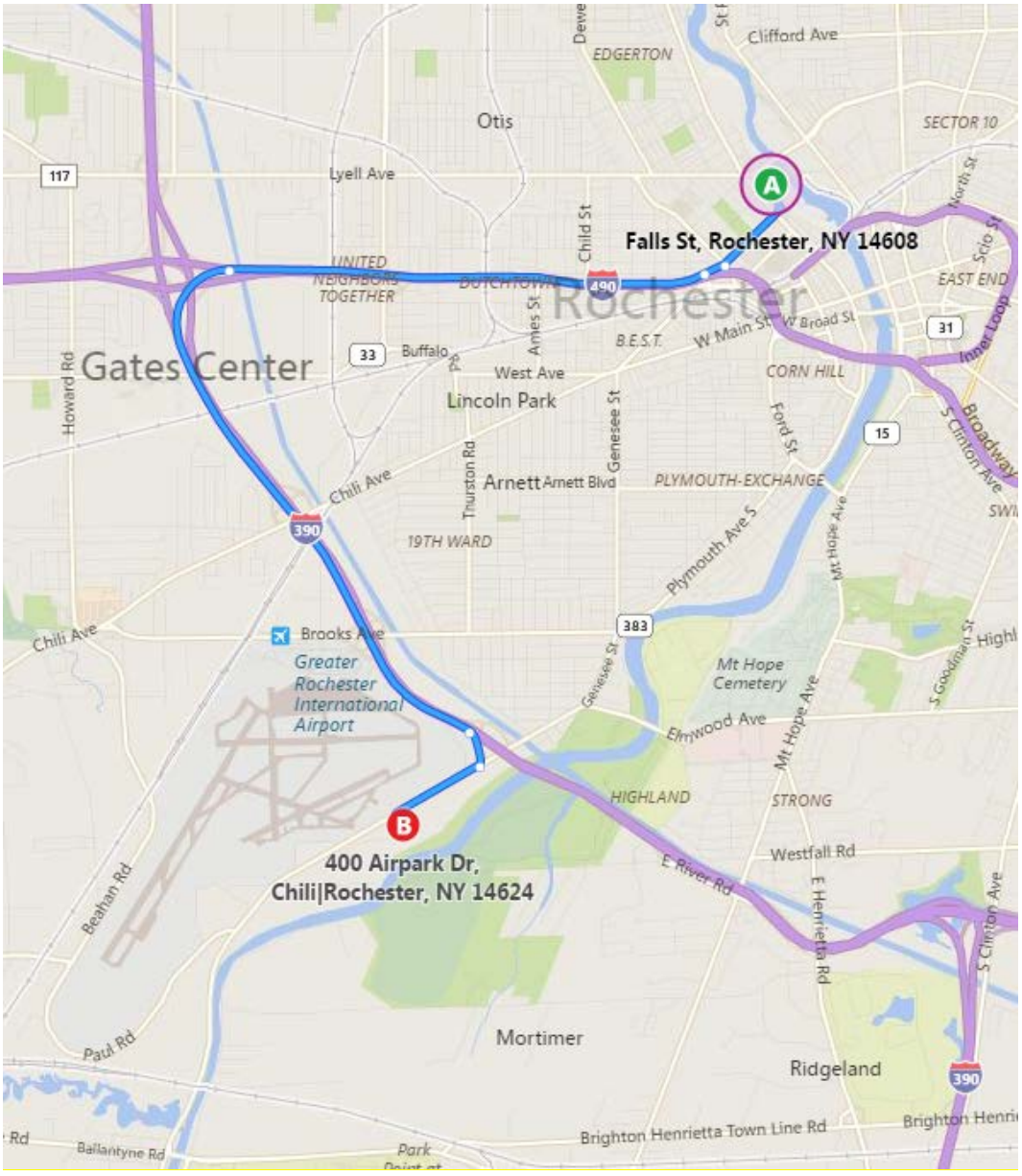
Directions from West Station to OnSite Occupational Health Center:

(6.8 mi – about 10 min.)

Start at foot of Falls Street

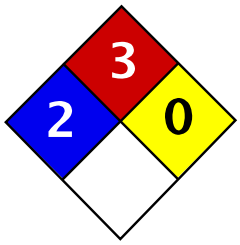
7. Head south on Falls St. Toward Brown St. (440 ft)
8. Turn right on Brown Street and Merge onto I-490 West (0.7 mi)
9. Continue on I-490 West to I-390 S (5.4 mi)
10. Take Exit 17 and merge onto NY-383 South/ Scottsville Rd. (0.2 mi).
11. Continue on NY-383 South/ Scottsville Rd. (0.5 mi.)
12. Turn left on Airpark Dr. (440 ft). Destination will be on the left.

End at 400 Air Park Dr. #90
Rochester, NY 14624



Appendix B

Safety Data Sheets



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

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

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
The substance is toxic to blood, bone marrow, central nervous system (CNS).
The substance may be toxic to liver, Urinary System.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

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

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

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

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Slightly flammable to flammable in presence of oxidizing materials.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire.
Reacts on contact with iodine heptafluoride gas.

Dioxygenyl tetrafluoroborate is as very powferful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition.
Contact with sodium peroxide with benzene causes ignition.
Benzene ignites in contact with powdered chromic anhydride.
Virgorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

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

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

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

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

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

Exposure Limits:

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States]
TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States]
TWA: 0.1 STEL: 1 from NIOSH
TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States]
TWA: 10 (ppm) from OSHA (PEL) [United States]
TWA: 3 (ppm) [United Kingdom (UK)]
TWA: 1.6 (mg/m3) [United Kingdom (UK)]
TWA: 1 (ppm) [Canada]
TWA: 3.2 (mg/m3) [Canada]
TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Aromatic. Gasoline-like, rather pleasant.
(Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

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

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone.
Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 930 mg/kg [Rat].
Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
Causes damage to the following organs: blood, bone marrow, central nervous system (CNS).
May cause damage to the following organs: liver, Urinary System.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects.
May affect genetic material (mutagenic).
May cause cancer (tumorigenic, leukemia))
Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism,and urinary system.
Eyes: Causes eye irritation.
Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and

other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system.
Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene
California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene
Connecticut carcinogen reporting list.: Benzene
Connecticut hazardous material survey.: Benzene
Illinois toxic substances disclosure to employee act: Benzene
Illinois chemical safety act: Benzene
New York release reporting list: Benzene
Rhode Island RTK hazardous substances: Benzene
Pennsylvania RTK: Benzene
Minnesota: Benzene
Michigan critical material: Benzene
Massachusetts RTK: Benzene
Massachusetts spill list: Benzene
New Jersey: Benzene
New Jersey spill list: Benzene
Louisiana spill reporting: Benzene
California Director's list of Hazardous Substances: Benzene

TSCA 8(b) inventory: Benzene
SARA 313 toxic chemical notification and release reporting: Benzene
CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R22- Harmful if swallowed.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R45- May cause cancer.
R62- Possible risk of impaired fertility.
S2- Keep out of the reach of children.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S39- Wear eye/face protection.
S46- If swallowed, seek medical advice immediately and show this container or label.
S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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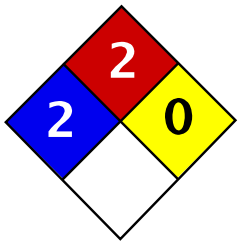
Last Updated: 11/06/2008 12:00 PM



Health	2
Fire	2
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Naphthalene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Naphthalene

Catalog Codes: SLN1789, SLN2401

CAS#: 91-20-3

RTECS: QJ0525000

TSCA: TSCA 8(b) inventory: Naphthalene

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: C10H8

Contact Information:

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

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Naphthalene	91-20-3	100

Toxicological Data on Ingredients: Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit]. VAPOR (LC50): Acute: 170 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

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

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 567°C (1052.6°F)

Flash Points: CLOSED CUP: 88°C (190.4°F). OPEN CUP: 79°C (174.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 5.9%

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

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

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

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Flammable solid.
Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

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

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

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

Exposure Limits:
Israel: TWA: 10 (ppm)
TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1995]
TWA: 52 STEL: 79 (mg/m3) from ACGIH [1995]
Australia: STEL: 15 (ppm)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 128.19 g/mole

Color: White.

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

Boiling Point: 218°C (424.4°F)

Melting Point: 80.2°C (176.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.162 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 4.4 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.038 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:
Partially dispersed in hot water, methanol, n-octanol.
Very slightly dispersed in cold water.
See solubility in methanol, n-octanol.

Solubility:
Partially soluble in methanol, n-octanol.
Very slightly soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Highly reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: May attack some forms of rubber and plastic

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 490 mg/kg [Rat].
Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 170 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.

DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 305.2 ppm 96 hour(s) [Trout].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Naphthalene, refined : UN1334 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Rhode Island RTK hazardous substances: Naphthalene
Pennsylvania RTK: Naphthalene
Florida: Naphthalene
Minnesota: Naphthalene
Massachusetts RTK: Naphthalene
TSCA 8(b) inventory: Naphthalene
TSCA 8(a) PAIR: Naphthalene
TSCA 8(d) H and S data reporting: Naphthalene: 06/01/87
SARA 313 toxic chemical notification and release reporting: Naphthalene: 1%
CERCLA: Hazardous substances.: Naphthalene: 100 lbs. (45.36 kg)

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

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

Other Classifications:

WHMIS (Canada):
CLASS B-4: Flammable solid.
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36- Irritating to eyes.
R40- Possible risks of irreversible effects.
R48/22- Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R48/23- Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R63- Possible risk of harm to the unborn child.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 2

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 2

Reactivity: 0

Specific hazard:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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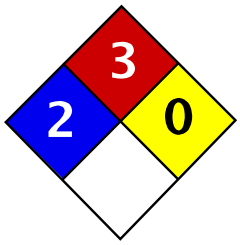

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

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

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

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

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide;

concentrated nitric acid, sulfuric acid + nitric acid; N_2O_4; $AgClO_4$; BrF_3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

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

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

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

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

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

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States]
TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN
TWA: 100 STEL: 150 from NIOSH [United States]
TWA: 375 STEL: 560 (mg/m^3) from NIOSH [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

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

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone.
Practically insoluble in cold water.
Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide.
Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride.
Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C.
Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 636 mg/kg [Rat].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin.
Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days.
Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite.
Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation.
Chronic Potential Health Effects:
Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis.
Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may

arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene
California prop. 65 (no significant risk level): Toluene: 7 mg/day (value)
California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene
Connecticut hazardous material survey.: Toluene
Illinois toxic substances disclosure to employee act: Toluene
Illinois chemical safety act: Toluene
New York release reporting list: Toluene
Rhode Island RTK hazardous substances: Toluene
Pennsylvania RTK: Toluene
Florida: Toluene
Minnesota: Toluene
Michigan critical material: Toluene
Massachusetts RTK: Toluene
Massachusetts spill list: Toluene
New Jersey: Toluene
New Jersey spill list: Toluene
Louisiana spill reporting: Toluene
California Director's List of Hazardous Substances.: Toluene
TSCA 8(b) inventory: Toluene
TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92
SARA 313 toxic chemical notification and release reporting: Toluene
CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S25- Avoid contact with eyes.
S29- Do not empty into drains.
S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/06/2008 12:00 PM

Occupational Health Guideline for Coal Tar Pitch Volatiles

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

Anthracene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Pale green solid with a faint aromatic odor.

Phenanthrene

Formula: $C_{14}H_{10}$
Synonyms: None
Appearance and odor: Colorless solid with a faint aromatic odor.

Pyrene

- Formula: $C_{16}H_{10}$
- Synonyms: None
- Appearance: Bright yellow solid

Carbazole

- Formula: $C_{12}H_9N$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Benzo(a)pyrene

- Formula: $C_{20}H_{12}$
- Synonyms: BaP, 3,4-benzopyrene
- Appearance and odor: Colorless solid with a faint aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for coal tar pitch volatiles is 0.2 milligram of coal tar pitch volatiles per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. NIOSH has recommended that the permissible exposure limit for coal tar products be reduced to 0.1 mg/m^3 (cyclohexane-extractable fraction) averaged over a work shift of up to 10 hours per day, 40 hours per week, and that coal tar products be regulated as occupational carcinogens. The NIOSH Criteria Document for Coal Tar Products and NIOSH Criteria Document for Coke Oven Emissions should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Coal tar pitch volatiles can affect the body if they are inhaled or if they come in contact with the eyes or skin.

- **Effects of overexposure**

Repeated exposure to coal tar pitch volatiles has been associated with an increased risk of developing bronchitis and cancer of the lungs, skin, bladder, and kidneys. Pregnant women may be especially susceptible to exposure effects associated with coal tar pitch volatiles. Repeated exposure to these materials may also cause sunlight to have a more severe effect on a person's skin. In addition, this type of exposure may cause an allergic skin rash.

- **Reporting signs and symptoms**

A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to coal tar pitch volatiles.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to coal tar pitch volatiles at potentially hazardous levels:

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the oral cavity, respiratory tract, bladder, and kidneys should be stressed. The skin should be examined for evidence of chronic disorders, for premalignant and malignant lesions, and evidence of hyperpigmentation or photosensitivity.

—Urinalysis: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. A urinalysis should be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment, as well as a test for red blood cells.

—Urinary cytology: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. Employees having 5 or more years of exposure or who are 45 years of age or older should have a urinary cytology examination.

—Sputum cytology: Coal tar pitch volatiles are associated with an excess of lung cancer. Employees having 10 or more years of exposure or who are 45 years of age or older should have a sputum cytology examination.

—14" x 17" chest roentgenogram: Coal tar pitch volatiles are associated with an excess of lung cancer. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Coal tar pitch volatiles are reported to cause an excess of bronchitis. Periodic surveillance is indicated.

—A complete blood count: Due to the possibility of benzene exposure associated with coal tar pitch volatiles, a complete blood count is considered necessary to search for leukemia and aplastic anemia.

—Skin disease: Coal tar pitch volatiles are defatting agents and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of these agents.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis, and semi-annually for employees 45 years of age or older or with 10 or more years' exposure to coal tar pitch volatiles.

• **Summary of toxicology**

Coal tar pitch volatiles (CTPV) are products of the destructive distillation of bituminous coal and contain polynuclear aromatic hydrocarbons (PNA's). These hydrocarbons sublime readily, thereby increasing the amounts of carcinogenic compounds in working areas. Epidemiologic evidence suggests that workers intimately exposed to the products of combustion or distillation of bituminous coal are at increased risk of cancer at many sites. These include cancer of the respiratory tract, kidney, bladder, and skin. In a study of coke oven workers, the level of exposure to CTPV and the length of time exposed were related to the development of cancer. Coke oven workers with the highest risk of cancer were those employed exclusively at topside jobs for 5 or more years, for whom the increased risk of dying from lung cancer was 10-fold; all coke oven workers had a 7-½-fold increase in risk of dying from kidney cancer. Although the causative agent or agents of the cancer in coke oven workers is unidentified, it is suspected that several PNA's in the CTPV generated during the coking process are involved. Certain industrial populations exposed to coal tar products have a demonstrated risk of skin cancer. Substances containing PNA's which may produce skin cancer also produce contact dermatitis; examples are coal tar, pitch, and cutting oils. Although allergic dermatitis is readily induced by PNA's in guinea pigs, it is only rarely reported in humans from occupational contact with PNA's; these have resulted largely from the therapeutic use of coal tar preparations. Components of pitch and coal tar produce cutaneous photosensitization; skin eruptions are usually limited to areas exposed to the sun or ultraviolet light. Most of the phototoxic agents will induce hypermelanosis of the skin; if chronic photodermatitis is severe and prolonged, leukoderma may occur. Some oils containing PNA's have been associated with changes of follicular and sebaceous glands which commonly take the form of acne. There is evidence that exposures to emissions at coke ovens and gas retorts may be associated with an increased occurrence of chronic bronchitis. Coal tar pitch volatiles may be associated with benzene, an agent suspected of causing leukemia and known to cause aplastic anemia.

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data—Anthracene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.24
4. Vapor density (air = 1 at boiling point of anthracene): 6.15
5. Melting point: 217 C (423 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Phenanthrene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.18
4. Vapor density (air = 1 at boiling point of phenanthrene): 6.15
5. Melting point: 100.5 C (213 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Pyrene**

1. Molecular weight: 202.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)

3. Specific gravity (water = 1): 1.28
4. Vapor density (air = 1 at boiling point of pyrene): 6.9
5. Melting point: 150.4 C (303 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Carbazole**

1. Molecular weight: 167.2
2. Boiling point (760 mm Hg): 355 C (671 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of carbazole): 5.8
5. Melting point: 246 C (475 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Benzo(a)pyrene**

1. Molecular weight: 252.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of benzo(a)pyrene): 8.7
5. Melting point: 179 C (354 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Reactivity**

1. Conditions contributing to instability: None hazardous
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: None
4. Special precautions: None

• **Flammability**

1. Flash point: Anthracene: 121 C (250 F) (closed cup); Others: Data not available
2. Autoignition temperature: Anthracene: 540 C (1004 F); Others: Data not available
3. Flammable limits in air, % by volume: Anthracene: Lower: 0.6; Others: Data not available
4. Extinguishant: Foam, dry chemical, and carbon dioxide

• **Warning properties**

Grant states that "coal tar and its various crude fractions appear principally to cause reddening and squamous eczema of the lid margins, with only small erosions of the corneal epithelium and superficial changes in the stroma, which disappear in a month following exposure. Chronic exposure of workmen to tar fumes and dust has been reported to cause conjunctivitis and discoloration of the cornea in the palpebral fissure, either near the limbus or, in extreme cases, across the whole cornea. Occasionally, epithelioma of the lid margin has been attributed to contact with coal tar."

MONITORING AND MEASUREMENT PROCEDURES

• **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Method**

Coal tar products may be sampled by collection on a glass fiber filter with subsequent ultrasonic extraction and weighing. An analytical method for coal tar pitch volatiles is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 1, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00267-3).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent skin contact with condensed coal tar pitch volatiles, where skin contact may occur.

• If employees' clothing may have become contaminated with coal tar pitch volatiles, employees should change into uncontaminated clothing before leaving the work premises.

• Clothing contaminated with coal tar pitch volatiles

should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of coal tar pitch volatiles from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the coal tar pitch volatiles, the person performing the operation should be informed of coal tar pitch volatiles's hazardous properties.

- Employees should be provided with and required to use splash-proof safety goggles where condensed coal tar pitch volatiles may contact the eyes.

SANITATION

- Workers subject to skin contact with coal tar pitch volatiles should wash with soap or mild detergent and water any areas of the body which may have contacted coal tar pitch volatiles at the end of each work day.
- Employees who handle coal tar pitch volatiles should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- Areas in which exposure to coal tar pitch volatiles may occur should be identified by signs or other appropriate means, and access to these areas should be limited to authorized persons.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to coal tar pitch volatiles may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from extraction and packaging from coal tar fraction of coking	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a binding agent in manufacture of coal briquettes used for fuel; use as a dielectric in the manufacture of battery electrodes, electric-arc furnace electrodes, and electrodes for alumina reduction	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture of roofing felts and papers and roofing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use for protective coatings for pipes for underground conduits and drainage; use as a coating on concrete as waterproofing and corrosion-resistant material; use in road paving and sealing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture and repair of refractory brick; use in production of foundry cores; use in manufacture of carbon ceramic items	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

- **Eye Exposure**

If condensed coal tar pitch volatiles get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with these chemicals.

- **Skin Exposure**

If condensed coal tar pitch volatiles get on the skin, wash the contaminated skin using soap or mild detergent and water. Be sure to wash the hands before eating or smoking and to wash thoroughly at the close of work.

- **Breathing**

If a person breathes in large amounts of coal tar pitch volatiles, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of releases until cleanup has been completed.
- If coal tar pitch volatiles are released in hazardous concentrations, the following steps should be taken:

1. Ventilate area of spill.

2. Collect released material in the most convenient and safe manner for reclamation or for disposal in sealed containers in a secured sanitary landfill.

• Waste disposal method:

Coal tar pitch volatiles may be disposed of in sealed containers in a secured sanitary landfill.

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• Committee on Biologic Effects of Atmospheric Pollutants, Division of Medical Sciences, National Research Council: *Particulate Polycyclic Organic Matter*, National Academy of Sciences, Washington, D.C., 1972.

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RESPIRATORY PROTECTION FOR COAL TAR PITCH VOLATILES

Condition	Minimum Respiratory Protection* Required Above 0.2 mg/m³
Particulate and Vapor Concentration	
2 mg/m³ or less	A chemical cartridge respirator with an organic vapor cartridge(s) and with a fume or high-efficiency filter. Any supplied-air respirator. Any self-contained breathing apparatus.
10 mg/m³ or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and with a fume or high-efficiency filter. A gas mask with a chin-style or a front- or back-mounted organic vapor canister and with a full facepiece and a fume or high-efficiency filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
200 mg/m³ or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode. A powered air-purifying respirator with an organic vapor cartridge and a high-efficiency particulate filter.
400 mg/m³ or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 400 mg/m³ or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors and particulates, including pesticide respirators which meet the requirements of this class. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: ISOBUTYLENE

1. Chemical Product and Company Identification

BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 20101

PRODUCT NAME: ISOBUTYLENE
CHEMICAL NAME: Isobutylene
COMMON NAMES/SYNONYMS: 2-Methylpropene, Isobutene
TDG (Canada) CLASSIFICATION: 2.1
WHMIS CLASSIFICATION: A, B1, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/7/96

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Isobutylene FORMULA: C4H8 CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	Simple Asphyxiant	Simple Asphyxiant	LC_{50} 620 mg/m^3/3H (rat)

[1] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[2] As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW

This product does not contain oxygen and may cause asphyxia if released in a confined area. Simple hydrocarbons can cause irritation and central nervous system depression at high concentrations. flammable.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	No

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
No	Yes	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects		
None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
Irritation may occur.

SKIN EFFECTS:
None anticipated as product is a gas at room temperature.

INGESTION EFFECTS:
Ingestion is unlikely.

INHALATION EFFECTS:
Product is relatively nontoxic. Simple hydrocarbons can irritate the eyes, mucous membranes and respiratory system at high concentrations.

Inhalation of high concentrations may cause dizziness, disorientation, incoordination, narcosis, nausea or narcotic effects.

This product may displace oxygen if released in a confined space. Maintain oxygen levels above 19.5% at sea level to prevent asphyxiation.

Effects of oxygen deficiency resulting from simple asphyxiants may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

NFPA HAZARD CODES		HMIS HAZARD CODES		RATINGS SYSTEM
Health:	1	Health:	1	0 = No Hazard
Flammability:	4	Flammability:	4	1 = Slight Hazard
Reactivity:	0	Reactivity:	0	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

4. First Aid Measures

EYES:
Never introduce oil or ointment into the eyes without medical advice! If pain is present, refer the victim to an ophthalmologist for further treatment and follow up.

SKIN:

Remove contaminated clothing and wash affected area with soap and water. If irritation persists, seek medical attention.

INGESTION:
Not normally required. Seek immediate medical attention.

INHALATION:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted (artificial) respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: Flammable liquid and vapor		
Flash point: -105 °F (-76 °C)	Method: Closed Cup	Autoignition Temperature: 869 °F (465 °C)
LEL(%): 1.8	UEL(%): 9.6	
Hazardous combustion products: Carbon monoxide, Carbon dioxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:
Isobutylene is heavier than air and may travel a considerable distance to an ignition source. Isobutylene is a flammable gas! Keep away from open flame and other sources of ignition. Do not allow smoking in storage areas or when handling.

EXTINGUISHING MEDIA:
Water, carbon dioxide, dry chemical.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop the flow of gas with a remote valve. Use water spray to cool fire exposed containers. If fire is extinguished and flow of gas is continued, increase ventilation to prevent a build up of a flammable/ explosive atmosphere. Extinguish sources of ignition.

Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above the liquid level with remote monitors. Limit the number of personnel in proximity to the fire. Evacuate surrounding areas to at least 3000 feet in all directions.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. Increase ventilation to prevent build up of a flammable/explosive atmosphere. Extinguish all sources of ignition! If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location

7. Handling and Storage

Earth bond and ground all lines and equipment associated with the product system. Electrical equipment should be non-sparking and explosion proof.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (<250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time.

Post "No Smoking" signs in storage or use areas.

For additional recommendations consult Compressed Gas Association Pamphlet P-1.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Isobuylene FORMULA: C4H8 CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	Simple Asphyxiant	Simple Asphyxiant	LC_{50} 620 mg/m^3/3H (rat)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

ENGINEERING CONTROLS:
Use local exhaust to prevent accumulation. Use general ventilation to prevent build up of flammable concentrations. May use hood with forced ventilation when handling small quantities. If product is handled routinely where the potential for leaks exists, all electrical equipment must be rated for use in potentially flammable atmospheres. Consult the National Electrical Code for details.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Protective gloves made of plastic or rubber.

RESPIRATORY PROTECTION:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes, safety shower, eyewash.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure at 70°F	: 39	psia
Vapor density at STP (Air = 1)	: 1.98	
Evaporation point	: Not Available	
Boiling point	: 19.5	°F
	: -6.9	°C
Freezing point	: -220.6	°F
	: -140.3	°C
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Insoluble	
Odor threshold	: Not Available	
Odor and appearance	: A colorless gas with an unpleasant odor similar to that of burning coal.	

10. Stability and Reactivity

STABILITY:
Stable

CONDITIONS TO AVOID (STABILITY):
None

INCOMPATIBLE MATERIALS:
Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon monoxide

11. Toxicological Information

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

No chronic effects data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Isobutylene	Isobutylene
HAZARD CLASS:	2.1	2.1
IDENTIFICATION NUMBER:	UN 1055	UN 1055
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Isoutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

Material Safety Data Sheet: **Simple Green® All-Purpose Cleaner**
Simple Green® Scrubbing Pad
Version No. 1300509A Date of Issue: January 2009 *ANSI-Z400.1-2003 Format*

Section 1: PRODUCT & COMPANY IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Simple Green® Scrubbing Pad
Additional Name: Simple Green® Concentrated Cleaner/Degreaser/Deodorizer

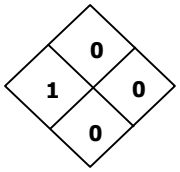
Manufacturer's Product Code Numbers: **Please refer to page 4*

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 ● 562-795-6000 Fax: 562-592-3830
Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Use of Product: An all purpose cleaner and degreaser used diluted in water for direct, spray and dip tank procedures. Scrubbing pad is used with water for manual scrubbing applications. Both are for cleaning water-safe surfaces.

Section 2: HAZARDS IDENTIFICATION

Emergency Overview: CAUTION. Mild eye irritant.
Simple Green@ is a dark green liquid with a sassafras odor. Scrubbing Pad is a green fibrous rectangle.



HMIS Rating:
Health = 1 = slight
Fire = 0
Reactivity, and Special = 0 = minimal

Eye Contact: Mild Eye Irritant.

Skin Contact: No adverse effects expected under typical use conditions. Prolonged exposure may cause dryness. Under this condition, use of gloves or skin moisturizer after washing may be indicated.

Ingestion: May cause stomach or intestinal upset if swallowed (due to detersive properties.)

Inhalation: No adverse effects expected under typical use conditions. Adequate ventilation should be present when using Simple Green® over a prolonged period of time. Open windows or ventilate via fan or other air-moving equipment if necessary.

Carcinogens: No ingredients are listed by OSHA, IARC, or NTP as known or suspected carcinogens.

Medical Conditions: No medical conditions are known to be aggravated by exposure to Simple Green®. Dermal-sensitive users may experience mild but reversible reactions.

UN Number: Not Required **Dangerous Goods Class:** Non-hazardous

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

The only ingredient of Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<4%) (Butyl Cellosolve; CAS No. 111-76-2) [*1% for Scrubbing Pad*]: the ACGIH TLV-TWA is 20 ppm (97 mg/m^3). Based upon chemical analysis, 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 Simple Green® are listed on the TSCA Chemical Substance Inventory.
This product does not contain any ingredients covered by the provisions of 29 CFR 1910.1200.

Section 4: FIRST AID MEASURES

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. Exposure to concentrate may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.

Section 5: FIRE FIGHTING MEASURES

Simple Green® is stable, not flammable, and will not burn. No special procedures required.

Flash Point/Auto-Ignition: Not flammable. Extinguishing Media: Not flammable/non-explosive.
Flammability Limits: Not flammable. Special Fire Fighting Procedures: None required.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid contact with eyes. Do not rub eyes with hands during cleanup. No special precautions for dermal contact are needed. Wash hands thoroughly after cleaning up spill or leak.

Method for cleaning up: 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.

Section 7: HANDLING AND STORAGE

No Special precautions are required. **This product is non-hazardous for storage and transport according to the U.S. Department of Transportation Regulations.** Simple Green® requires no special labeling or placarding to meet U.S. Department of Transportation requirements.

UN Number: Not Required **Dangerous Goods Class:** Non-hazardous

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits: The 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.) No special precautionary measures required under normal use conditions.

Ventilation: No special ventilation, precautions or respiratory protection is required during normal use. Large-scale use 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 Simple Green®, based on 20 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.

Eye protection: Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate. Eye protection not generally required. Wash hands after using wipes.

Skin protection: 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 on the skin may lead to temporary, but reversible, irritation. Rinse completely from skin after contact.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION – continued –

General hygiene conditions: There are no known hazards associated with this material when used as recommended. The following general hygiene considerations are recognized as common good industrial hygiene practices:

- Avoid breathing vapor or mist.
- Avoid contact with eyes.
- Wash thoroughly after handling and before eating, drinking, or smoking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Cleaner is a dark green liquid, pad is a fibrous green matrix; both exhibit a sassafras odor.			
Specific Gravity:	1.010 ± 0.010	**Vapor Pressure:**	18 mm Hg @ 20°C; 23.5 mmHg @ 26°C
Evaporation:	>1 (butyl acetate = 1)	**Vapor Density:**	1.3 (air = 1)
Water Solubility:	100%	**Density:**	8.5 lbs/gallon
Boiling Point:	100.6°C (212°F)	**pH:**	9.5 ± 0.3
Ash Content:	At 600°F: 1.86% by weight	**Nutrient Content:** Phosphorus: 0.3% by formula Nitrogen <1.0% by weight (fusion and qualitative test for ammonia) Sulfur: 0.6% by weight (barium chloride precipitation method)	
Freezing Point: Approx -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: 0.006 mmHg @ 20°C			
Volatile Organic Compounds (VOCs): CARB Method 310 3.8% SCAQMD Method 313 2.8%	Cleaner meets CARB & BAAQMD regulations. Cleaner must be diluted 1:1 with water to Meet SCAQMD Rule 1171 & Rule 1122 VOC requirements for solvent cleaning operations. [*Scrubber VOCs = 3.3% prior to dilution w/water*]		

Section 10: STABILITY AND REACTIVITY

Stability: Stable
Materials to Avoid: None known
Hazardous Decomposition Products: None expected

Section 11: TOXICOLOGICAL INFORMATION

Toxicology information is based on chemical profile of ingredients and extrapolation of data from similar formulas.

Acute Toxicity: Oral LD_{50} (rat) >5 g/kg body weight*
Dermal LD_{50} (rabbit) >2 g/kg body weight

**Calculation from OECD series on testing and assessment number 33, Chapter 3.2*

Eye Irritation: Moderate/Mild reversible eye irritation may occur based on relevant laboratory studies. This potential is reduced by immediate rinsing of eyes in case of eye contact.

Dermal Irritation: Mild, reversible skin irritation may occur based on relevant laboratory studies. A 6-hour exposure to human skin under a patch did not produce irritation

Repeat Exposure Via Skin Contact: Based on relevant laboratory studies, no toxic effects are expected to be associated with daily skin exposures (with up to 2 g/kg/day tested for 13 weeks on rabbits). Skin irritation may, however, occur with repeated or prolonged exposures.

Reproductive Effects Assessment: Based on relevant laboratory studies (CD-1 mouse 18-week fertility assessment continuous breeding), no adverse effects on reproduction, fertility, or health of offspring are expected.

Section 12: ECOLOGICAL INFORMATION

Hazard to wild animals & aquatic organisms: Low, based on toxicological profile.

Biodegradability: Readily biodegradable based on biodegradation profile,
PRO/FT CBT-AC 014-7 "Ready Biodegradability: Closed Bottle Test" OECD, and OECD 302B laboratory tests

Environmental Toxicity Information: It is important not to allow the runoff from cleaning into closed systems such as decorative ponds. Always protect closed systems with tarps or dikes if necessary.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of in accordance with all applicable local, state and federal laws. Dispose of used or unused product, and empty containers in accordance with the local, State, Provincial, and Federal regulations for your location. Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

This product is non-hazardous for transport according to the U.S. Department of Transportation Services
UN Number: Not required Dangerous Goods Class: Non-hazardous

Section 15: REGULATORY INFORMATION

*Reportable components:

All components are listed on:	EINECS and TSCA Inventory
No components listed under:	Clean Air Act Section 112
SARA:	This material contains 2-Butoxyethanol, < 4%, (CAS# 111-76-2) which is subject to the reporting requirements of Section 313 of SARA Title III and 49 CFR Part 373.

RCRA Status:	Not a hazardous waste.	CERCLA Status:	No components listed
TSCA TRI Reporting:	Not required / Not listed	CA PROP. 65 Status:	No components listed

Section 16: OTHER INFORMATION

Questions about the information found on this MSDS should be directed to:
SUNSHINE MAKERS, INC. – TECHNICAL DEPARTMENT
15922 Pacific Coast Hwy. Huntington Harbour, CA 92649

Phone: 800/228-0709 [8am-5pm Pacific time, Mon-Fri] *Fax:* 562/592-3830 *Email:* infoweb@simplegreen.com

CAGE CODE 1Z575
GSA/FSS - CONTRACT NO. GS-07F-0065J
National Stock Numbers & Industrial Part Numbers:

	Part Number	NSN	Size
Simple Green	13012	7930-01-342-5315	24 oz spray (12/case)
	13005	7930-01-306-8369	1 Gallon (6/case)
	13006	7930-01-342-5316	5 Gallon
	13016	7930-01-342-5317	15 Gallon
	13008	7930-01-342-4145	55 Gallon
Scrubbing Pad	Part Number	NSN	Size
	10224	7930-01-346-9148	Each (24/case)

Retail Numbers:

Part Number	Size
13002	16 oz Trigger (12/case)
13005	1 Gallon (6/case)
13013	24 oz Trigger (12/case)
13014	67 oz / 2 L (6/case)
13033	32 oz Trigger (12/case)

** part number is for both industrial and retail*

****International Part Numbers May Differ.**

DISCLAIMER: The information provided with this MSDS is furnished in good faith and without warranty of any kind. Personnel handling this material must make independent determinations of the suitability and completeness of information from all sources to assure proper use and disposal of this material and the safety and health of employees and customers. Sunshine Makers, Inc. assumes no additional liability or responsibility resulting from the use of, or reliance on this information.

Appendix C

Heat Stress and Cold Stress Guidelines

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.

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

Appendix D

Forms

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**

GEI Consultants

Daily Safety Briefing Log 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):

- ☐ General PPE Usage
- ☐ Hearing Conservation
- ☐ Respiratory Protection
- ☐ Personal Hygiene
- ☐ Exposure Guidelines
- ☐ Decon Procedures
- ☐ Confined Space
- ☐ Slips, Trips, Falls
- ☐ Heat Stress
- ☐ Cold Stresses
- ☐ Site Control
- ☐ Work Zones
- ☐ Lockout/Tagout
- ☐ Excavation Safety
- ☐ Confined Space
- ☐ Traffic Safety
- ☐ Changes to the HASP
- ☐ Initial Review of Hazard Evaluation
- ☐ Emergency Procedures (include route to hospital)
- ☐ Other (Specify):
- ☐ Other (Specify):

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.

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:**	**Project Manager:**
Briefing Conducted by:		**Signature:**

This sign-in log documents the project specific-briefing conducted in accordance with the HASP and GEI H&S policy. GEI personnel who perform work on site are required to attend the Project briefing and to acknowledge it's receipt. Applicable health and safety SOPs are also required to be reviewed in this briefing and attached as an appendix to the HASP. 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 Health&SafetyCommittee@geiconsultants.com.

TOPICS COVERED (check all those covered):

☐	General PPE Usage	☐	Excavation Safety	☐	SOP:
☐	Hearing Conservation	☐	Confined Space	☐	SOP:
☐	Respiratory Protection	☐	Traffic Safety	☐	SOP:
☐	Personal Hygiene	☐	Changes to the HASP	☐	SOP:
☐	Exposure Guidelines	☐	Site Control	☐	SOP:
☐	Decon Procedures	☐	Work Zones	☐	SOP:
☐	Emergency Procedures (include route to hospital)	☐	Lockout/Tagout	☐	SOP:
☐	Confined Space	☐	Review of Hazard Evaluation	☐	SOP:
☐	Slips, Trips, Falls	☐	Other (Specify):	☐	SOP:
☐	Heat Stress	☐	Other (Specify):	☐	SOP:
☐	Cold Stress	☐	Other (Specify):	☐	SOP:

Personnel Sign-in List

Printed Name	Signature

GEI Consultants

Utility Clearance Documentation

Project: _____

Site: _____

Drilling Location ID: _____

Driller: _____

GEI PM: _____

GEI Field Team Leader: _____

Utility Drawings Reviewed: _____

Provided By: _____

Reviewed By: _____

One Call Utility Clearance Call Date: _____

Utility Clearance Received back from (list utilities): _____

Completed By (Company): _____ Date: _____

GEI Staff Responsible for Oversight: _____

Metal Detector Survey (yes/no): _____

Drilling Location Cleared by: _____

Contractor: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Physical Test Pit Clearance Required (yes/no): _____

Contractor: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Handclearing Performed: _____ Date: _____

Contractor: _____

GEI Staff Responsible for Oversight: _____

Notes: _____

_____

Based upon the best available information, appropriate utility clearance proceedures were performed for the invasive work specified. If client ordered/site specific deviations from existing GEI utility clearance procedures exist, they are approved by the client signature below.

Client Signature (Optional): _____ Date: _____

GEI, Inc. Representative: _____ Date: _____

Appendix E

Health and Safety SOPs

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 should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and 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 notify the Project Manager and Corporate Health and Safety Officer (CHSO) and go to the hospital emergency room. The doctor, possibly in consultation with the state or local health department, will decide if you need a rabies vaccination. Decisions to start vaccination 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. An Accident Report Form should be completed and submitted per GEI's accident reporting procedures.

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 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 Site Safety Officer (SSO) and the CHSO 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

1.4.1.1 Lyme Disease

Lyme disease is caused by infection from a deer tick that carries a spirochete. 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." Unfortunately, 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.

Personnel should check themselves when in areas that could harbor deer ticks, wear light color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a GEI employee has been bitten by a tick, the CHSO should be contacted immediately. An Accident Report form must be completed by the individual in compliance with the Accident Reporting procedure outlined in the Corporate Health and Safety Manual.

From left to right: The deer tick adult female, adult male, nymph, and larva on a centimeter scale.

The tick can be removed by pulling gently at the head with tweezers. If tweezers are not available, cover your fingers with tissue paper and use them 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 then be disinfected with an antiseptic wipe. All mouth parts must be removed from the skin. If the tick is removed by breaking off the mouth parts, an irritation or infection may occur. Also, the organism that is causing the disease can still enter the body through the skin. The employee will be offered the option for medical treatment by a physician, which typically involves antibiotics. If personnel feel sick or have signs similar to those above, they should notify the SSO and the CHSO immediately.

Treatment with antibiotics is effective and recovery is usually complete. In the first stage antibiotics are usually given orally. Second and third stage treatment, however is prolonged and recovery may take longer. Antibiotic treatment is usually provided intravenously for second and third stage Lyme disease.

1.4.1.2 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.

1.4.1.3 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*).

In New York State, most cases of ehrlichiosis have been reported on Long Island and in the Hudson Valley. 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 one to three weeks after the bite of an infected tick. However, not every exposure results in infection.

1.4.1.4 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). Fewer than 50 cases are reported annually in New York State. 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. Most of the cases in New York State have occurred on Long Island. RMSF is characterized by a sudden onset of moderate to high fever (which can last for two or three 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 two weeks of the bite of an infected tick.

*(Information on Ehrlichiosis, Babesiosis, and Rocky Mountain Spotted Fever was derived from the New York State Department of Health).

1.4.2 Mosquito-Borne Disease

1.4.2.1 West Nile Virus

West Nile Virus (WNV) is a mosquito-borne infection transmitted through the bite of an infected mosquito. The symptoms of WNV 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.
- 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 Environmental Protection Agency (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) 20 to 30 percent DEET
- **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)

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 products 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, sumac, and oak, exists when performing fieldwork in wooded or boggy areas. These plants can cause 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.

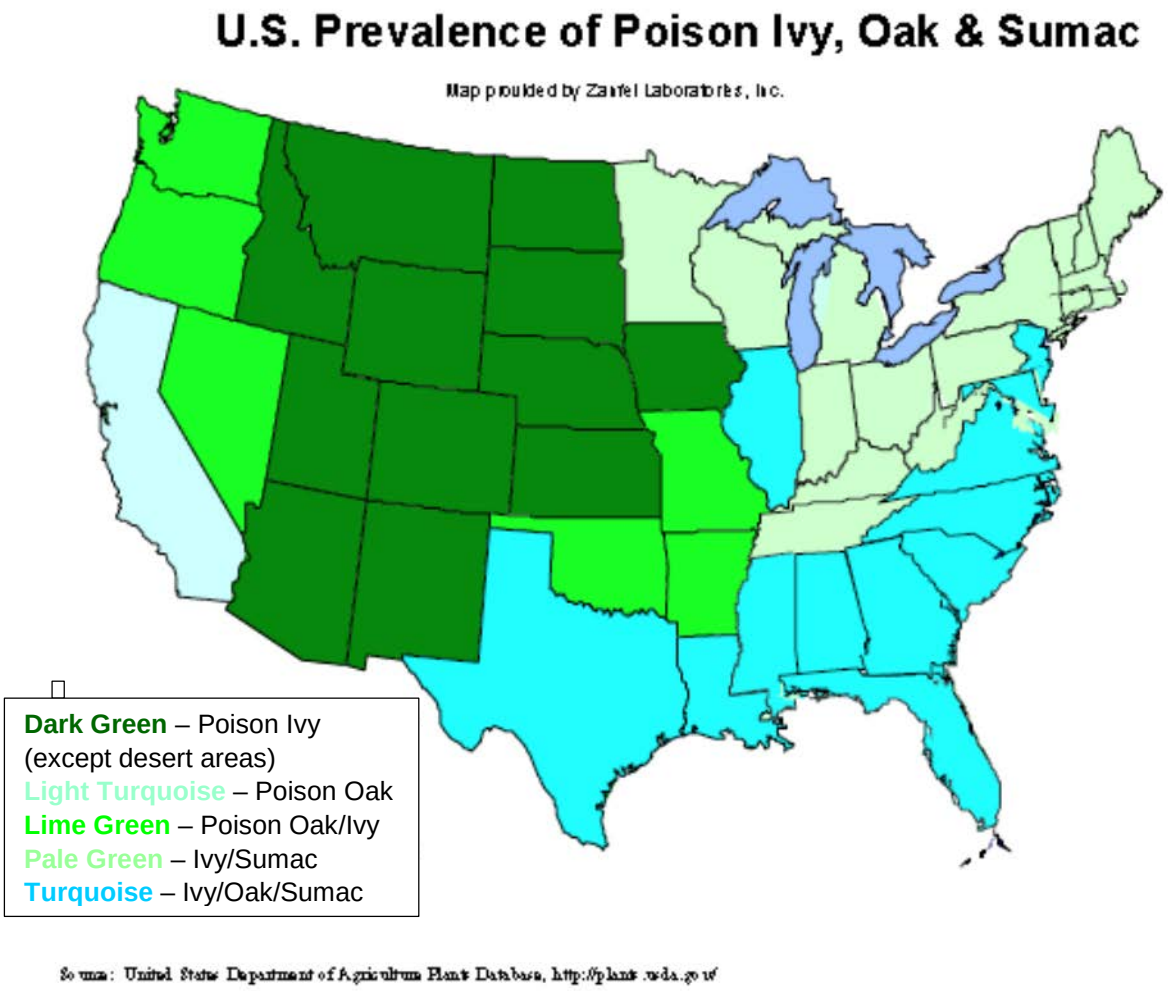
Poison sumac can be present in the form of a flat-topped shrub or tree. It has fern-like leaves, which are velvety dark green on top and pale underneath. The branches of immature trees have a velvety "down." Poison sumac has white, "hairy" berry clusters. Poison sumac grows exclusively in very wet or flooded soils, usually in swamps and peat bogs, in the eastern United States.

Poison oak can be present as a sparingly 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 Oak

Poison Ivy

Poison Sumac



To prevent exposure to these poisonous plants:

- Barrier skin creams, such as lotion containing bentoquatum (Tecnu®), may offer some protection prevent the occurrence of exposure symptoms.
- Wear long sleeves, long pants, boots, and gloves.

Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. Susceptible individuals should identify themselves to the SSO or GEI Project Manager. 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.
- 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 CHSO and complete and submit an Accident Report Form.

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 (CSO) 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. Potential respiratory exposure to biological agents can also occur through the inhalation of aerosols produced during sediment handling activities. Personal protective equipment 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

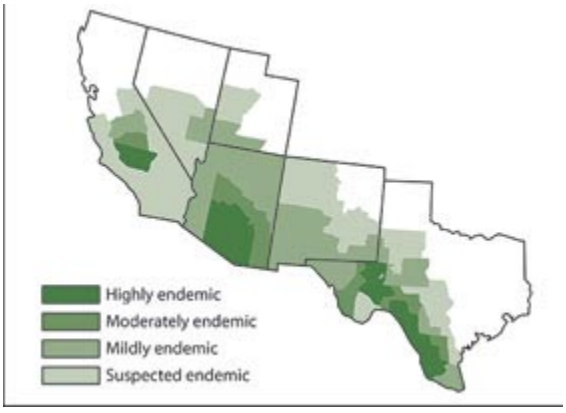
Valley Fever is an illness that usually affects the lungs. It is caused by the fungus Coccidioides immitis that lives in the top 2 to 12 inches of soil in many parts of California. When fungal spores are present, any work activity that disturbs the soil, such as digging, grading or other earth moving 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 figure below.

California county-specific coccidioidomycosis incidence rates, 2011

Center for Infectious Diseases - Division of Communicable Disease Control

Infectious Diseases Branch - Surveillance and Statistics Section



When present, symptoms usually occur between seven 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 steps are important to take 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 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, provide 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). Employers must 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).
- Take measures to reduce transporting spores off site, such as:
    - Clean tools, equipment, PPE and vehicles before transporting off site.
    - If employee's clothing is likely to be heavily contaminated with dust, provide coveralls and change rooms, and showers where possible.

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

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

1.10 Attachments

None

1.11 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

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 when performing first aid or cardiopulmonary resuscitation (CPR). Employees may also come into contact with these materials 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 infection 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 Health and 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, this equipment 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 Health and Safety Plan for specific PPE requirements.

Gloves 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 notify the Corporate Health and Safety Officer (CHSO) and Human Resources 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 at no cost. Required records for exposed employees will be kept confidential.

1.3.4 Training

Employees with a reasonable risk for exposure must attend 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 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.5 Reference

OSHA 29 CFR 1910.1030 - Bloodborne Pathogens.

1.6 Attachments

1.7 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

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 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.
- When parking a vehicle at a job site, the employee should position the vehicle in a manner to reduce or eliminate the need to operate the vehicle in reverse. 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 procedure makes the employee aware of other vehicles, equipment, and structures within the backup radius of the vehicle.

When driving a rental vehicle or GEI vehicle that you are unfamiliar with orient yourself 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.

- Adjusting mirrors (rear and side).
- 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 yourself and your 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 your risks on the road.

Do not start the vehicle until each passenger and their belongings are secured in the vehicle.

- Remember that driving above or below the speed limit can increase the likelihood of a collision.
- If you notice that 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 your lights.
- Notify the police if you observe motorist who is driving suspiciously.
- Follow the rules of the road. Do not contest the "right of way" or try to race another car during a merge. Be respectful of other motorists.
- Allow large vehicles, including tractor trailers, extra breaking distance, turning radius, and avoid traveling in their blind spots.
- Do not follow too closely. GEI employees should use a "three-second following distance" or a "three-second plus following distance."
- While driving be cautious, aware, and responsible.
- Use extra caution and reduce speed in construction areas and school zones.
- Be aware of pedestrians, bicyclists, and motorcyclists.

1.4 Cellular Phone Use and Other Distractions

Refer to the Human Resources policy on use of cellular telephones while operating a vehicle on company business.

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

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 your car and following guidelines:

- Have your headlights properly aimed. Misaimed headlights blind other drivers and reduce your ability to see the road.
- Alcohol severely impairs your driving ability and acts as a depressant.
- Avoid smoking when you drive. Smoke's nicotine and carbon monoxide hamper night vision.
- Lights will not help the driver see better in early twilight, but they will make it easier for other drivers to see you. Do not overdrive your headlights. You should be able to stop inside the illuminated area. If you do not, you create a blind crash area in front of your vehicle.
- 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.
- Make frequent stops for light snacks and exercise. If you are too tired to drive, stop in a safe area and get some rest.
- Observe driving safety as soon as the sun goes down. Twilight is one of the most difficult times to drive, because your eyes are constantly changing to adapt to the growing darkness.

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 your windshield wipers and check the condition of your wiper blades. If wipers leave streaks on your windshields, replace the blades.
- It is recommended that a windshield washer/antifreeze solution is used during winter conditions.
- Check your lights and periodically clear them of snow and dirt.
- Car batteries need extra power in cold conditions. Make sure the battery's terminals are clean and cables are secure.

- Keep your 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 you and the car ahead of you.
- Reduce your speed and do not exceed the posted limit.
- If you start to lose traction take your foot off the gas and gradually reduce your speed. Accelerate slowly once you feel traction is regained.
- If you start to skid, steer in the direction of the skid. Remember, steering can be more important than braking on slippery roads.

1.6.3 Driving In the Rain

To prevent losing control of your 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 you need to stop or slow, do not brake hard or lock the wheels.
- Maintain mild pressure on the brake pedal.

If you skid, ease your foot off the gas, and carefully steer in the direction you want the front of the car to go. For cars without anti-lock brakes, avoid using your brakes. This procedure, known as "steering into the skid," will bring the back end of the car in line with the front. If your car has anti-lock brake systems (ABS), brake firmly as you "steer into the skid."

Hydroplaning happens when the water in front of your tires builds up faster than your car's weight can push it out of the way. The water pressure causes your car to lose contact with the road surface and slide on a thin layer of water between your tires and the road. At this point, your car can be completely out of contact with the road, and you are in danger of skidding or drifting out of your 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 you. If you begin to hydroplane, do not brake or turn suddenly. This could throw your car into a skid. Ease your foot off the gas until the car slows and you can feel the road again. If you need to brake, do it gently with light pumping actions. If your car has ABS, then brake normally; the car's computer will mimic a pumping action, when 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 publicly or privately maintained roads or in situations where four-wheel-drive vehicles are required, the appropriate vehicle for the situation will be used.

1.7 Driver Training

GEI employees are required to complete driver safety training every 3 years. Employees will complete the examination at the end of each module and forward the training certificate to Human Resources.

1.8 Limitations

Follow safety procedures as defined in the site-specific HASP.

1.9 References

National Safety Council
Oklahoma Safety Council
GEI Consultants, Inc. Employee Handbook

1.10 Attachments

1.11 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

HS-005 Electrical Safety and Lockout/Tagout

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, or working near overhead utilities. This standard operating procedure (SOP) applies to work performed near exposed live parts (involving either direct contact or by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present. GEI employees are not considered qualified persons and will not work on electric circuit parts or equipment that have not been de-energized. All employees are required to comply with the restrictions and limitations imposed upon them during the use of lockout. The authorized employees are those employees who have been trained and may conduct a lockout in accordance with this procedure. Affected employees are those employees who observe machines or equipment being locked out to perform servicing or maintenance. These employees will not attempt to start, energize, or use that machine or equipment.

Lockout/tagout procedures will be followed when working on or around machines, equipment, or any system where the unexpected energization or start-up of the machine or equipment or release of stored energy can cause injury to the employee. Lockout/tagout also applies to electric generation, and pumping plant inspections and appurtenances. Normally GEI employees will follow the client's lockout/tagout procedures when available. If the client does not have specific lockout/tagout procedures in place, use these guidelines at a minimum.

1.2 General

Employees who face a risk of electric shock, but who are not qualified persons, will be trained and become familiar with electrically related safety practices in the GEI annual Health and Safety course. 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 and include a review of the HASP requirements.

Annual health and safety training will include review of this electrical safety SOP and GEI's lock out tag out 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. All training and/or retraining is be documented, signed, and certified by the

GEI Regional Health and Safety Officer (RHSO) or Corporate Health and Safety Officer (CHSO). 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 illumination is provided that enables the employees to work safely. Protective shields, protective barriers, or insulating materials (if necessary) will be used when working in confined or enclosed work spaces where electrical hazards may exist. If portable ladders are utilized to work in these types of spaces they will have non-conductive side rails.

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 on site. When working within the perimeter of the substation, 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.
- Maintain the minimum approach distance (MAD) from bus bars, transformer/capacitor electrodes, and overhead transmission/distribution lines.
- Avoid working within the perimeter of a substation in conditions of high humidity, rain, or thunderstorms.
- 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** includes:

- 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.
- Conduct work under the supervision of the client's Health and Safety representative per client requirements.
- Conductive items of jewelry or clothing will not be worn unless they are rendered non-conductive by covering, wrapping, 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 in/or around energized conductors, which is not anticipated to be the case.
- Use insulated lineman's gloves when handling equipment that may come into contact with underground utilities.
- EH-rated footwear is required when working on site.
- 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.
- Maintain a minimum clearance of 16 feet from bus bars, transformer/capacitor electrodes, and overhead transmission/distribution lines.
- Maintain a minimum offset of three feet from marked underground transmission/distribution lines.
- Avoid working on substation in conditions of high humidity, rain, or thunderstorms.
- Stop work immediately and vacate the work area in the event lightning is observed.

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 on site 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. In addition, vehicular and mechanical equipment will maintain minimum clearance distances of 10 feet. Site personnel will assume that all electrical equipment at surface, subsurface, and overhead locations is 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. All GEI employees will use proper PPE when working within the active substation, including flame resistant clothing and EH-rated safety boots. 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 excavation location.

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 parts. 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 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.

1.2.1.1 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 hardhats will be worn by the operating personnel at all times when utilizing hand and power tools. Ground fault interrupter (GFI)-equipped circuits will be used for all power tools.

1.2.1.2 Lockout/Tagout

Lockout/tagout procedures need to be followed when working on or around machines, equipment, or any system where the unexpected energization or start-up of the machine

or equipment or release of stored energy can cause injury to the employee. Hazardous energy includes any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy. Other energy can include stored energy such as equipment held under tension, pressurized lines, and capacitors,

GEI uses a red Master Lock® 1 31/32-inch high body high-visibility aluminum padlock, keyed differently, with a 1 1/16-inch shackle, or its equivalent for lock out activities. An employee's lock and tag must not be removed by anyone other than the employee who installed the lock and tag unless removal is accomplished under the direction of the CHSO.

When GEI employees are working on project sites where a group lock out is required, the locked-out device will first be secured using a folding scissors clamp that has many padlock holes capable of holding it closed. Each employee/subcontractor will apply their own padlock to the clamp. The locked-out device cannot be activated until all workers have signed off on their portion of the project and removed their padlock from the clamp. The lead contractor responsible for the group lock out will assign an authorized employee who has primary responsibility for the number of employees working under the protection of a group Lockout or Tagout device. GEI employees will not act as the Authorized Employee.

Only GEI employees who have completed electrical safety training may conduct a lock out tag out procedure. Normally GEI employees will follow the client's lockout/tagout procedures. If the client does not have specific lockout/tagout procedures to follow, use these guidelines at a minimum:

- Prior to conducting any lockout/tagout procedures, notify all affected employees.
- Identify the type, magnitude, and hazards of the energy that the machine/equipment uses.
- Shut down the machine/equipment by the normal stopping procedure. (stop button, open switch, close valve, etc.).
- Disconnect the machine/equipment from the energy source.
- Stored or residual energy (such as capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
- Using the correct type of lockout/tagout device, lockout the machine/equipment with an assigned individual lock by placing a lock on each energy isolating device. **Only the employee performing the work should have a key to this lock.**
- **Locks can be obtained from the RHSO. This lock will have a GEI approved tag that allows the employee to write their name and date on the tag.**

- Lockout devices, where used, will be affixed in a manner that will hold the energy isolating devices in a safe or off position. Locking devices will always be used on energy isolating devices designed with the capability of being locked.
- Tagout devices, where used, will be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the safe or off position.
- Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely as possible to the device in a position that will be immediately obvious to anyone attempting to operate the device.
- Confirm that the machine/equipment has been disconnected by attempting to operate or turn the machine/equipment on. If the machine does not operate, it is now locked out.
- If, during repair or maintenance activities, the machine or equipment is required to be energized, list the location of lockout/tagout device(s) that can be removed to accomplish this. Only the lockout/tagout devices absolutely necessary to allow the equipment or machine to be energized or partially energized should be removed. After the equipment or machine has been cycled or jogged, the lockout/tagout devices will be reapplied and above steps will be repeated prior to commencing work.
- When the machine/equipment is ready to be returned to service, make sure all tools are removed and the system is operationally intact. Verify that all employees are in a safe position and have been removed from the area.
- Remove the lockout/tagout devices and reenergize the machine/equipment.
- Notify affected employees that the service or maintenance work is complete and the machine/equipment is ready for use.
- Program shall state that authorized & affected positions shall be identified.

This lock out tag out program will be reviewed by the Health and Safety Committee annually. Health and safety audits are conducted by the CHSO or RHSO to document compliance with these requirements.

1.3 Assured Equipment Grounding

1.3.1 Ground-fault circuit interrupters

GEI employees will use approved ground-fault circuit interrupters for personnel protection at construction sites. Equipment will be plugged into receptacles protected by a ground fault circuit interrupters (GFCI), or extension cords with built-in GFCIs.

Each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, 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 attachment cap or plug shall 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 (for example, when a cord set is run over), and at intervals not to exceed 3 months, except that cord sets 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 marked and disposed of properly. Inspections will be documented.

1.4 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.

1.5 References

OSHA 29 CFR 1910.147 Appendix A – The control of hazardous energy (lockout/tagout)

1.6 Attachments

None

1.7 Contact

Corporate Health and Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-006 Excavations and Trenches

1.1 Objective

GEI employees may be involved with projects that include some type of excavation and trenching as part of the work activities. The following guidelines will be followed when excavations or trenches are present on GEI projects.

1.2 General

This standard operating procedure (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) should 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 should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

Hazards associated with excavations and trenches can include collapse, falls, falling objects, hazardous atmospheres, and incidents involving mobile equipment.

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 should meet the following requirements:

- The excavation must be inspected daily by a competent person to identify potential hazards associated with the excavation. GEI generally does not act as the competent person.
- A protective system should be in place for trenches or excavations greater than 5- feet in depth.
- Employees will be protected from vehicular traffic by the use of barricades, cones and tape or other physical barriers.
- The protective system should 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.
- 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.

- Excavations and trenches greater than four 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.

- Where oxygen deficiency (atmospheres containing less than 20.7 percent 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 shall be tested before employees enter excavations greater than four feet in depth.

When GEI is subcontracting the excavation activities:

- Care should be taken not to create new hazards like narrow walkways along edges of an excavation.
- Heavy equipment should 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).
- When required guardrails will be installed for crossings and walkways to provide fall protection.
- 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. Water should be directed away from the excavation or trench whenever possible. 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.

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 should not be conducted.

1.3 Soil Classifications

The soil classification system means a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability.

1) Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

2. Type A means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

a) The soil is fissured; or
b) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
c) The soil has been previously disturbed; or
d) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
e) The material is subject to other factors that would require it to be classified as a less stable material.

3) Type B means:

a) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
b) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
c) Previously disturbed soils except those which would otherwise be classed as Type C soil.
d) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
e) Dry rock that is not stable; or
f) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

4) Type C means:

a) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
b) Granular soils including gravel, sand, and loamy sand; or
c) Submerged soil or soil from which water is freely seeping; or
d) Submerged rock that is not stable, or
e) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Where soils are configured in layers, i.e., where a layered geologic structure exists, the soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e., where a Type C soil rests on top of stable rock.

1.4 GEI Requirements for the Excavation/Trenches Competent Person

Although GEI does not normally act as the competent person for excavations and trenches this person should have and be able to demonstrate the following:

- Training, experience, and knowledge of:
  - soil analysis;
  - use of protective systems; and
  - requirements of 29 CFR Part 1926 Subpart P.
- Ability to detect:
  - conditions that could result in cave-ins;
  - failures in protective systems;
  - hazardous atmospheres; and
  - other hazards including those associated with confined spaces.
- Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.

1.5 Test Equipment And Methods For Evaluating Soil Type

Many kinds of equipment and methods are used to determine the type of soil prevailing in an area, as described below.

A. Pocket Penetrometer. Penetrometers are direct-reading, spring-operated instruments used to determine the unconfined compressive strength of saturated cohesive soils. Once pushed into the soil, an indicator sleeve displays the reading. The instrument is calibrated in either tons per square foot (tsf) or kilograms per square centimeter (kPa). However, Penetrometers have error rates in the range of ± 20-40%.

   1. Shearvane (Torvane). To determine the unconfined compressive strength of the soil with a shearvane, the blades of the vane are pressed into a level section of undisturbed soil, and the torsional knob is slowly turned until soil failure occurs. The direct instrument reading must be multiplied by 2 to provide results in tons per square foot (tsf) or kilograms per square centimeter (kPa).

2. Thumb Penetration Test. The thumb penetration procedure involves an attempt to press the thumb firmly into the soil in question. If the thumb makes an indentation in the soil only with great difficulty, the soil is probably Type A. If the thumb penetrates no further than the length of the thumb nail, it is probably Type B soil, and if the thumb penetrates the full length of the thumb, it is Type C soil. The thumb test is subjective and is therefore the least accurate of the three methods.
3. Dry Strength Test. Dry soil that crumbles freely or with moderate pressure into individual grains is granular. Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can be broken only with difficulty) is probably clay in combination with gravel, sand, or silt. If the soil breaks into clumps that do not break into smaller clumps (and the soil can be broken only with difficulty), the soil is considered unfissured unless there is visual indication of fissuring.

B. Plasticity or Wet Thread Test. This test is conducted by molding a moist sample of the soil into a ball and attempting to roll it into a thin thread approximately 1/8 inch (3 mm) in diameter (thick) by 2 inches (50 mm) in length. The soil sample is held by one end. If the sample does not break or tear, the soil is considered cohesive.

C. Visual Test. A visual test is a qualitative evaluation of conditions around the site. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. If the soil remains in clumps, it is cohesive; if it appears to be coarse-grained sand or gravel, it is considered granular. The evaluator also checks for any signs of vibration.

During a visual test, the evaluator should check for crack-line openings along the failure zone that would indicate tension cracks, look for existing utilities that indicate that the soil has previously been disturbed, and observe the open side of the excavation for indications of layered geologic structuring.

The evaluator should also look for signs of bulging, boiling, or sluffing, as well as for signs of surface water seeping from the sides of the excavation or from the water table. If there is standing water in the cut, the evaluator should check for "quick" conditions. In addition, the area adjacent to the excavation should be checked for signs of foundations or other intrusions into the failure zone, and the evaluator should check for surcharging and the spoil distance from the edge of the excavation.

1.6 Shoring Types

Shoring is the provision of a support system for trench faces used to prevent movement of soil, underground utilities, roadways, and foundations. Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. Shoring systems consist of posts, wales, struts, and sheeting. There are two basic types of shoring, timber and aluminum hydraulic.

Hydraulic shoring can be a prefabricated strut and/or wale system manufactured of aluminum or steel. Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install or remove hydraulic shoring. Other advantages of most hydraulic systems are that they:

- Are light enough to be installed by one worker;
- Are gauge-regulated to ensure even distribution of pressure along the trench line;
- Can have their trench faces "preloaded" to use the soil's natural cohesion to prevent movement; and
- Can be adapted easily to various trench depths and widths.

All shoring should be installed from the top down and removed from the bottom up. Hydraulic shoring should be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.

Pneumatic Shoring works in a manner similar to hydraulic shoring. The primary difference is that pneumatic shoring uses air pressure in place of hydraulic pressure. A disadvantage to the use of pneumatic shoring is that an air compressor must be on site.

- Screw jack systems differ from hydraulic and pneumatic systems in that the struts of a screw jack system must be adjusted manually. This creates a hazard because the worker is required to be in the trench in order to adjust the strut. In addition, uniform "preloading" cannot be achieved with screw jacks, and their weight creates handling difficulties.
- Single-Cylinder Hydraulic Shores. Shores of this type are generally used in a water system, as an assist to timber shoring systems, and in shallow trenches where face stability is required.
- Underpinning. This process involves stabilizing adjacent structures, foundations, and other intrusions that may have an impact on the excavation. As the term indicates, underpinning is a procedure in which the foundation is physically reinforced. Underpinning should be conducted only under the direction and with the approval of a registered professional engineer.

1.7 Shielding Types

Trench Boxes are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar incidents. The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench boxes and the excavation side are backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those which the system was designed to withstand.

Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching. The box should extend at least 18 in (0.45 m) above the surrounding area if there is sloping toward excavation. This can be accomplished by providing a benched area adjacent to the box.

Earth excavation to a depth of 2 ft (0.61 m) below the shield is permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of possible loss of soil from behind or below the bottom of the support system. Conditions of this type require observation on the effects of bulging, heaving, and boiling as well as surcharging, vibration, adjacent structures, etc., on excavating below the bottom of a shield. Careful visual inspection of the conditions mentioned above is the primary and most prudent approach to hazard identification and control.

1.8 Sloping And Benching

Maximum allowable slopes for excavations less than 20 ft (6.09 m) based on soil type and angle to the horizontal are as follows:

Soil type	height / Depth ratio	Slope angle
Stable Rock	Vertical	90°
Type A	¾:1	53°
Type B	1:1	45°
Type C	1½:1	34°
Type A (short-term)	½:1	63°
(For a maximum excavation depth of 12 ft)		

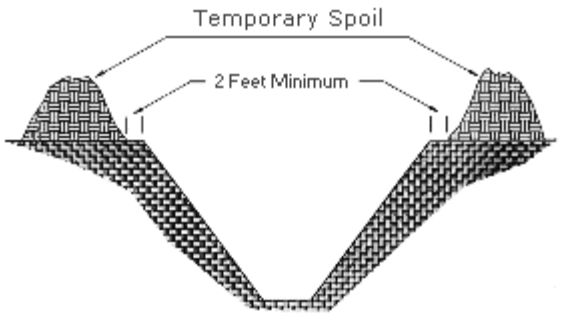
There are two basic types of benching, simple and multiple. The type of soil determines the horizontal to vertical ratio of the benched side.

As a general rule, the bottom vertical height of the trench must not exceed 4 ft (1.2 m) for the first bench. Subsequent benches may be up to a maximum of 5 ft (1.5 m) vertical in Type A soil and 4 ft (1.2 m) in Type B soil to a total trench depth of 20 ft (6.0 m). All subsequent benches must be below the maximum allowable slope for that soil type. For Type B soil the trench excavation is permitted in cohesive soil only.

1.9 Spoil

Temporary spoil must be placed no closer than 2 ft (0.61 m) from the surface edge of the excavation, measured from the nearest base of the spoil to the cut. This distance should not be measured from the crown of the spoil deposit. This distance requirement ensures that loose rock or soil from the temporary spoil will not fall on employees in the trench.

Spoil should be placed so that it channels rainwater and other run-off water away from the excavation. Spoil should be placed so that it cannot accidentally run, slide, or fall back into the excavation.



Permanent spoil should be placed at some distance from the excavation. Permanent spoil is often created where underpasses are built or utilities are buried. The improper placement of permanent spoil, i.e. insufficient distance from the working excavation, can cause an excavation to be out of compliance with the horizontal-to-vertical ratio requirement for a particular excavation. This can usually be determined through visual observation. Permanent spoil can change undisturbed soil to disturbed soil and dramatically alter slope requirements.

1.10 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

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).

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.

1.11 References

OSHA 29 CFR 1926.650 – Subpart P; *Excavations.*
OSHA Construction eTool - http://www.osha.gov/SLTC/etools/construction/index.html
OSHA Technical Manual (OTM), Section V: Chapter 2 - Excavations: Hazard Recognition In Trenching And Shoring

1.12 Attachments

None

1.13 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

HS-007 General Safety Requirements

1.1 Objective

GEI is committed to providing its employees with a safe and healthy work environment. To maintain a safe work environment, GEI has established general safety requirements to promote safe work practices.

1.2 General Health and Safety Training

GEI requires employees to complete Health and Safety Training on an annual basis. Project employees must have completed, at a minimum, GEI's Non-HAZWOPER training modules, or when required, HAZWOPER training modules before beginning on-site work activities. Both training modules include spill response training. The training will include materials available for use, proper waste disposal, and communication procedures. Additional spill response information is outlined in the site specific health and safety plan that will contain specific chemical information based on site hazards.

In addition, field staff must be current in First Aid and CPR Training. Site-specific safety training will also be completed before beginning work on each project site. Further Health and Safety training requirements can be found in Section 2 of the GEI Health and Safety Manual.

1.3 Tailgate Meetings

Health and Safety tailgate meetings will be conducted by the GEI Project Manager or Site Safety Officer (SSO), and be recorded in the GEI field book or on the GEI daily safety briefing log. Employees on-site will sign the daily safety briefing log to indicate attendance.

1.4 Health and Safety Plans

GEI projects must have a health and safety plan (HASP) before beginning site work. GEI HASP templates are located on the Health and Safety page on the GEI intranet. Specific requirements for HASPs are located in Section 7 of GEI's Health and Safety Manual. After the HASP has been completed, it must be sent to the Corporate Health and Safety Officer (CHSO) and the Regional Health and Safety Officer (RHSO) for review. Project employees must read the HASP and sign the signature page to document that they have read, understood, and will comply with the requirements of the HASP. The site-specific HASP must be kept on-site at all times.

1.5 Personal Protective Equipment

Project-specific personal protective equipment (PPE) will be identified in the HASP based on the hazards present during work tasks. Required PPE must be worn on the project site. More information regarding PPE is located in Section 6 of GEI's Health and Safety Manual.

1.6 Fire Protection and Prevention

The work site should be kept clear of flammable materials and debris. GEI field personnel should know where fire extinguishers are located, and be familiar in the use of the extinguisher. Information on the correct use of a fire extinguisher is included in GEI's general health and safety training. Call 911(or other number identified in the project HASP) in the event of a fire.

1.7 Accident/Incident Reporting

The following accident reporting procedures must be followed:

- Seek medical attention.
- Notify your supervisor.
- Notify CHSO and Human Resources (HR) within two hours of the accident/incident.
- Complete Accident Reporting Form (found on the Health and Safety page of the GEI Intranet or on the GEI App) within **24 hours** and send to the CHSO and Human Resources. Refer to Section 8 of the GEI Health and Safety Manual for more information.

1.8 Near Miss Reporting

GEI employees will complete a near-miss reporting form if a hazardous or unsafe condition or near miss is observed. The near-miss reporting form is located on the Health and Safety page of the GEI Intranet. Refer to Section 8 of the GEI Health and Safety Manual for more information.

1.9 Housekeeping and Spill Control

Work areas, passages, chemical/drum storage areas, and stairs will be kept clean and clear of debris. Debris will be removed from the project site at regular intervals. Chemical substances should be stored in proper containers to minimize the potential for a spill. Containers must be properly labelled in accordance with GEI's Hazard Communication program. If containers contain confirmed hazardous waste, proper

hazardous waste labels and dates will be displayed on the containers. Chemicals will be kept in closed containers and only opened when removing or adding product. If chemicals are repackaged into smaller containers they must display, at a minimum, the name of the product and its hazards.

Containers must be stored properly on an impervious surface, such as concrete, or on secondary containment trays. Containers must be protected from environmental conditions, such as rain and stormwater. Spill control equipment must be maintained in container storage areas. A proper spill kit must contain the appropriate supplies for materials that may be spilled. Supplies must be easily accessible when required, and considerations must be made for both the type and quantity of material. The following equipment, if required, should be in sufficient supply to implement clean up procedures:

- Over pack drums/Buckets
- Alconox™ detergent concentrate
- Absorbent pads
- Liquid detergent and paper towels
- Plastic trash bags

Nitrile gloves and safety glasses will also be located in the spill control station. Hazardous materials used on the Site will be properly labeled, stored, and handled. Safety Data Sheets (SDS) will be available to potentially exposed employees.

If a hazardous waste spill or material release occurs, the Site Safety Officer (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.

Spilled product and clean up materials will be containerized, labeled, dated, and stored properly while arrangements for sampling and proper disposal are made. If the GEI client has specific emergency response procedures employees will follow their procedures including notification, spill response, and clean up.

1.10 Illumination

Project sites will be illuminated either with natural or artificial illumination, in compliance with OSHA regulations.

1.11 Sanitation

Hand-washing is an essential form of protection from chemical and biological exposures and illness. GEI employees should wash their hands after performing work tasks and regularly throughout the day. If soap and water are not available, hand sanitizers and/or wipes should be used.

1.12 Machinery, Tools, Material, and Equipment

Machinery, tools, material, and equipment will be kept in good working condition and will be inspected by a competent person. Unsafe equipment will be identified as unsafe by tagging or locking the controls to render them inoperable. Arrangements will be made to repair or dispose of damaged or unsafe equipment.

1.13 Vehicles

GEI's motor vehicles will be maintained in accordance with the GEI fleet maintenance program. Each GEI-owned vehicle will have a fire extinguisher and first aid kit. Additional fire extinguishers and first aid kits are kept in each GEI office for use in personal or rental vehicles.

1.14 Heavy Equipment

GEI employees will keep a line of sight between them and heavy equipment operators. If a GEI employee needs to communicate with heavy equipment operators, they will use hand signals or direct communication with the operator. GEI employees should not:

- Operate or climb on heavy equipment

- Approach heavy equipment while it is in operation.
- Use cellular telephones when working near operating equipment.

For more information regarding heavy equipment, refer to GEI's SOP HS-018 Heavy Equipment.

1.15 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.16 Attachments

None

1.17 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-010 Inclement Weather

1.1 Objective

Inclement weather can affect work activities and pose safety hazards to employees working in these conditions. The following guidelines will be followed when weather conditions become a safety concern.

1.2 General

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 encounters with biological 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 Health and Safety page of the GEI intranet.

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 storm use extreme caution. When driving, turn your 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 about 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. 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 and increase the potential for traffic accidents and becoming trapped 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 Manual.

1.2.5 High Wind and Tornados

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 tornado wind

speeds exceed the 40 mph, stop work and seek shelter immediately if a tornado is seen. If a tornado siren is sounded move immediately to safety indoors and then move to a windowless interior space, basement, stair well, 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 will 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 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 extreme weather conditions can best be accomplished if the conditions are anticipated. Monitor local weather conditions prior to starting work.

1.4 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

1.5 Attachment

None

1.6 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer

South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-012 Noise Exposures

1.1 Objective

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.

1.2 Execution

Prior to working on any project, an Activity Analysis or Job Hazard Analysis must be performed by the Project Manager or their designee to evaluate the potential hazards and identify steps to be taken to protect all workers from any hazard. If projects involve high levels of noise from such sources as heavy equipment, power tools, pumps, generators, or any other noise source employees must take steps to remove the noise exposure. GEI has an established Hearing Conservation Program located in the GEI Health and Safety Manual.

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.

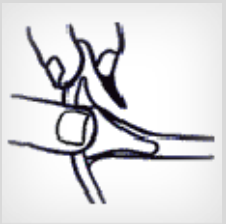
The first option for employee protection from hazardous noise levels is to remove the hazard by taking away the source of the noise or using engineering controls to reduce the level. If this cannot be accomplished, the next control measure to be used is to remove the worker from the source. This can be done by moving the work area to a quieter location or distancing the worker 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. The final option for worker protection is personal protective equipment (PPE). Disposable ear plugs are made available to GEI employees and are to be used when required. Additional means of hearing protection will be provided, such as ear muffs, if the disposable ear plugs are not adequate.

Employees should be aware of surroundings such as moving equipment, traffic, and other site hazards when wearing hearing protection.

1.3 Proper Use of Hearing Protection

DISPOSABLE EAR PLUG FITTING INSTRUCTIONS

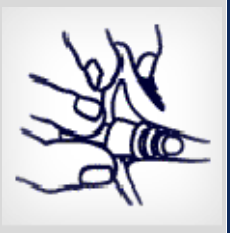
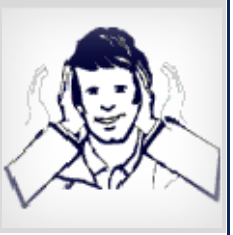
Before fitting any ear plugs, make sure your hands are clean.
Foam ear plugs are disposable and not intended for reuse.

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. Remove and refit following instructions.	
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. 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.

Reusable ear plugs should be inspected and cleaned often in soapy water. If they become hard, torn, or deformed they should be replaced.

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. Remove and refit following instructions.	
Always remove ear plugs slowly, twisting them to break the seal. If you remove them too quickly, you could damage your ear drum.	

1.4 Limitations

- Follow safety procedures as outlined in the site-specific health and safety plan (HASP) at all times.
- Any type of hearing protection that is used must be worn properly in order to provide the intended amount of protection. If PPE is not worn properly, exposure to the hazard may occur.

1.5 References

OHSA 29 CFR 1910.95 – Occupational Noise Exposure
OHSA 29 CFR 1926.101 – Hearing Protection
Texas American Safety Company (TASCO)

1.6 Attachment

None

1.7 Contact

GEI Corporate Health and Safety Officer
GEI Atlantic Regional Health and Safety Officer
GEI New England Regional Health and Safety Officer
GEI Midwest Regional Health and Safety Officer
GEI Western Regional Region Health and Safety Officer

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.

Clients or local agencies may have additional requirements or procedures for the marking 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 Health and Safety page of the GEI intranet.
- The contractor or GEI employee visits the site and marks out each exploration area with white paint, flags, or stakes. Mark-outs will be performed wearing required PPE, including eye protection when using spray paint to perform the mark-out.
- 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 provides this information to the mark-out program call center with a phone call or electronic submittal. 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 or in other project documents.

- If known, the contractor will also notify non-member utility operators (such as apartment complexes, commercial complexes, railroads with communication cables, etc.).
- 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, including 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

- Before the intrusive work activities begin, the contractor 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 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.
- 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 them (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 contractor damages this, leave the damaged utility exposed and immediately call the utility owner.
- 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.
- If the contractor/consultant 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 five 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 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.

1.4 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 Health and Safety Committee for assistance.

1.5 Attachment

Attachment A – Standard Utility Color Codes
Attachment B – GEI Utility Clearance Documentation Form

1.6 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

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

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Utility Clearance Documentation

Client: _____

Project: _____

Site: _____

Excavation/Drilling Location ID: _____

Excavator/Driller: _____

GEI PM: _____

GEI Field Team Leader: _____

Utility Drawings Reviewed: _____

Provided By: _____

Reviewed By: _____

Utility Clearance Call Date: _____

Utility Clearance Received back from (list utilities): _____

Completed By (Company): _____ Date: _____

GEI Staff Responsible for Oversight: _____

Metal Detector Survey (yes/no): _____

Drilling Location Cleared by: _____

Contractor: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Private Location Clearance Required (yes/no): _____

Contractor: _____ Date: _____

Methods used for utility location (i.e. GPR, electronic pipe location) _____

GEI Staff Responsible for Oversight: _____

Hand clearing Performed: _____ Date: _____

Contractor: _____

GEI Staff Responsible for Oversight: _____

Notes: _____

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 exist, they are approved by the client signature below.

Client Signature (Optional): _____ Date: _____

GEI, Inc. Representative: _____ Date: _____

STANDARD OPERATING PROCEDURES
HS-017 Water Safety

1.1 Objective

The objective of this standard operating procedure (SOP) provides requirements and best practices for GEI personnel during field activities taking place on board a boat/barge or when working near water.

1.2 General

This SOP is intended for use by employees where there is the potential to perform work while on board a boat/barge or when working near water. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential hazards and the control methods to be implemented by GEI employees. The site-specific HASP, project hazards, and control methods should be reviewed during the project safety briefing and documented on the Project Safety Briefing/HASP sign-off page in the HASP.

1.3 Working Near Water

OSHA Construction Industry Standards (29 CFR 1926.106) state: "employees working over or near water, **where the danger of drowning exists**, will be provided a Coast Guard-approved life jacket or buoyant work vests." OSHA General Industry Standards (1910) do not address working over or near water; therefore, GEI uses the OSHA Construction Standard for any work near water.

The following safety devices will be used by employees working near water:

- **Life Jacket or Personal Flotation Devices (PFD).** Employees will be required to wear U. S. Coast Guard approved personal flotation devices that are marked or labeled Type III PFD or a Type V PFD that is marked or labeled for use as a work vest for commercial use or for use on vessels. GEI employees will inspect personal floatation devices for defects that could alter their strength or buoyancy prior to, and after, each use. Defective units will not be used and will be marked as defective and properly disposed of.

- **Ring Buoys.** U. S. Coast Guard approved ring buoys with at least 90 feet of line will be readily available for emergency rescue operations. Distance between ring buoys will not exceed 200 feet.

- **Life-saving Skiff.** When GEI employees are working over or adjacent to water, at least one lifesaving skiff will be immediately available for potential rescue purposes.

These requirements can be superseded by the use of 100 percent fall protection. If an employee cannot fall into the water as a result of the use of active or passive fall protection, there is no danger of drowning and a PFD is not required. The type of fall protection or the need for a PFD will be described in the site specific HASP. If 100 percent fall protection is in place, the boat must, at a minimum, have Coast Guard approved PFDs on board for each person and at least one throw-able flotation device, such as a life ring.

GEI employees will not work alone, where practical, in situations where a drowning hazard exists.

1.4 Boat/Barge Safety Practices

Boat safety practices will be conducted in general accordance with guidance provided in the United States Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM) 385-1-1 and the United States Coast Guard. The following safety practices will be adhered to:

- If there is an accident the USCG must be notified. The attached USCG accident report form can be used to document the accident. Federal law requires the operator, or owner, if the operator is deceased or unable to make the report, to file a boating accident report with the State reporting authority when, as a result of an occurrence that involves a boat or its equipment:
    - A person dies
    - A person disappears from the vessel under circumstances that indicate death or injury
    - A person is injured and requires medical treatment beyond first aid
    - Damage to vessels and other property totals $2,000 (lower amounts in some states and territories) or more
    - The boat is destroyed
- Boats operated by GEI will comply with Coast Guard regulations.
- Any GEI employee that is operating a boat is required to take a Boating Safety Course. The course will in accordance with the requirements of state in which the boat will be operated. Documentation of course completion must be sent to the Health & Safety Committee.
- The boat operator will need to be familiar with USGS navigation rules.
- Any boat operator, whether GEI or a subcontractor, is not to exceed 12 hours of duty time in a 24 hour period.
- GEI employees will wear a PFD as described in Section 1.3 when on board a boat or barge.
- For a boating activity where the vessel launches and is no longer in view of on-shore personnel, a Float Plan must be completed and left with a reliable person who can be depended upon to notify the Coast Guard, or other rescue

organizations, should you not return or check-in as planned. If there is a change of plans after leaving, be sure to notify the person holding the Float Plan. Please see the attached USCG Float Plan Form.

- For a task requiring more than one day, daily communications with the reliable person must be maintained.
- The consumption of alcoholic beverages will not be permitted aboard boats on which GEI employees are conducting company business. The use of illegal drugs is never permitted.
- Employees working on a boat will monitor the weather, incorporating, as appropriate, National Oceanic and Atmospheric Administration (NOAA) marine weather broadcasts and other local commercial weather forecasting services as may be available.
- For retrieving a person overboard, the boat operator, or other competent person will throw a life ring, that is attached to the boat with at least 90 feet of rope, and use a ladder attached to the boat or the boat step transom to allow the person to climb out of the water.
- Emergency procedures for fire, person overboard, and capsizing will be reviewed on the first day of operations and when there is a change of personnel occurs.
- Check with your local and state agency to verify their boat law/regulations.
- Beware of Carbon Monoxide poisoning when the boat engine is running in closed or poorly ventilated areas.

1.4.1 Boating Safety Equipment

The USCG requires particular safety equipment to be aboard a boat. This list includes those items as well as other equipment that GEI requires as a minimum. Other safety equipment may be required based on the type and size of the boat being operated.

The boat will be equipped with:

- At least one mounted ABC-1 type Coast Guard-approved portable fire extinguisher.
- A life ring attached to at least 90 feet line.
- A Coast Guard approved PFD for each person on board as well as one Type IV throwable device (life ring).
- A visual distress signal.
- VHF-FM Marine Radio with Digital Selective Calling System.
- An efficient sound-producing device.

- One approved backfire flame arrestor device on each carburetor of all gasoline engines installed after April 25, 1940, except outboard motors.
    - Devices must be marked to show compliance with SAE J-1928 or UL 1111 Standards.
- Ladder attached to the boat or the boat step transom.
- An adequately sized first aid kit.
- Charts and Navigation Aids.

1.5 Training

1.5.1 General

Training will be conducted for employees unfamiliar with the use of safety equipment and PPE required by this SOP. Employees working over or near water will be trained in their responsibilities and the safe work practices associated with working on or near water.

1.5.2 Operating a Boat

A Boating Safety Course is required for all employees that will be operating a boat. The course will in accordance with the requirements of state in which the boat will be operated. There is no regulated refresher date; therefore GEI will require the course be retaken every 5 years as a refresher. Documentation of course completion must be sent to the Health & Safety Committee.

1.6 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.7 References

Occupational Safety and Health Administration (OSHA) 29 CFR 1926.106 – Subpart E: Personal Protective and Life Saving Equipment: Working Over or Near Water.

U.S. Code of Federal Regulations (CFR) Title 33 – Navigation and Navigable Waters; Chapter I – United States Coast Guard.

United States Army Corps of Engineers, Safety and Health Requirements Manual (EM), 385-1-1.November 3, 2003 – Section 19 Floating Plant and Marine Activities

United States Army Corps of Engineers, Safety and Health Requirements Manual (EM), 385-1-1 September 15, 2008 – Section 01.C Physical Qualifications of Employees

1.8 Attachments

USCG Float Plan Form

USCG Navigation Rules

USCG Accident Report Form

1.9 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

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 for GEI personnel.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for working near heavy equipment. The site-specific health and safety plan (HASP) should include a hazard assessment for the project 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 Health and Safety page of the GEI intranet.

1.3 Heavy Equipment

Heavy equipment (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 a reflective, high-visibility safety vest.
- Always keep your distance from moving vehicles.
- Do not assume the vehicle 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 heavy equipment 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 vehicles may be moving closer than you may think.
- 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 vehicle.
- Always stay out from under a suspended load on cranes or hoists, even if it means taking the long way around.
- Do not walk behind a piece of equipment that is backing up. The operator may not see you.
- 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 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.5 References

OSHA 29 CFR 1926.600 – Subpart O; Motor Vehicles, Mechanized Equipment, and Marine Operations.
www.*toolboxtopics.com*/Construction
Caterpillar Safety – http://safety.cat.com/

1.6 Attachment

None

1.7 Contact

Corporate Health & Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

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 for GEI personnel.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for working near heavy equipment. The site-specific health and safety plan (HASP) should include a hazard assessment for the project 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 Health and Safety page of the GEI intranet.

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Heavy equipment (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 a reflective, high-visibility safety vest.
- Always keep your distance from moving vehicles.
- Do not assume the vehicle 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 heavy equipment 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 vehicles may be moving closer than you may think.
- 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 vehicle.
- Always stay out from under a suspended load on cranes or hoists, even if it means taking the long way around.
- Do not walk behind a piece of equipment that is backing up. The operator may not see you.
- 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 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.5 References

OSHA 29 CFR 1926.600 – Subpart O; Motor Vehicles, Mechanized Equipment, and Marine Operations.
www.*toolboxtopics.com*/Construction
Caterpillar Safety – http://safety.cat.com/

1.6 Attachment

None

1.7 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-020 Aerial Lifts

1.1 Objective

GEI employees may be required to use aerial lifts to access equipment or work areas as part of work activities. Aerial lifts may be used on construction or manufacturing sites. Aerial lifts are rented from equipment suppliers; GEI does not own aerial lifts. Any GEI employee who has the potential for working on or utilizing aerial lifts will receive training on the use and hazards associated with each type of aerial lift used. Only authorized trained employees are allowed to operate this type of equipment.

1.2 General

This standard operating procedure (SOP) is specific to mobile aerial lifts that are used to position personnel so that they can conduct work at elevated heights. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential hazards for employees to using aerial lifts 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 Health and Safety page of the GEI intranet.

The following guidelines must be followed when GEI employees use an aerial lift. Aerial lift operators must complete training and demonstrate proficiency in the recognition and mitigation of hazards associated with the operation of aerial lifts prior to the use of this equipment. In addition, GEI employees are required to:

1. Read the manufacturer's operator's manual for each model of lift that will be operated.
2. Complete hands-on training with competent and experienced trainers and demonstrate proper operation under expected operating conditions before independently operating any lift.
3. Submit documentation of training to the Corporate Health Safety Officer (CHSO) and Regional Health and Safety Officer (RHSO).

This SOP is not a substitute for appropriate training, as described above. Supervisors are required to notify the CHSO and the RHSO if lifts are used by persons they supervise so that training and hazard evaluations can be completed. Models commonly used at GEI include manually and self-propelled units; vertical masts, scissor lifts, articulating booms, and telescoping booms. Examples of each of these are shown below.



1.3 Regulatory Basis

Several Occupational Safety and Health Administration (OSHA) regulations and American National Standards Institute (ANSI) standards apply to aerial lifts and include provisions for design, operator training, and safe operating practices. See the References section of this SOP. In addition GEI has other health and safety programs and SOPs that complement this SOP including Fall Protection (Program), Ladder Safety (HS-011), and Permit Required Confined Spaces (Program).

1.4 General Safety Precautions

- Personnel operating aerial lifts must be trained and authorized on each type of aerial lift used. Training must include:
  - Explanations of electrical, fall, and falling object hazards;
  - Procedures for dealing with hazards;
  - Recognizing and avoiding unsafe conditions in the work setting;
  - Instructions for correct operation of the lift (including maximum intended load and load capacity);
  - Demonstrations of the skills and knowledge needed to operate an aerial lift before operating it on the job;
  - When and how to perform inspections; and
  - Manufacturer's requirements.
- Modifications to lifts are not allowed.
- Most lifts are designed for operation on relatively flat surfaces with minimal slope (less than 5 percent). Do not operate on surfaces that exceed the manufacturer's maximum rated slope.
- Lifts are to be used strictly for the purposes for which they were designed and in accordance with manufacturer's specifications and instructions.
- Equipment will have a working back-up alarm that is audible above surrounding noise level or use a spotter when backing.
- Boom and basket load limits specified by the manufacturer will not be exceeded.

- Prior to each day's operation, the GEI employee must conduct a worksite and machine inspection, including applicable function tests of controls and safety devices. Tests will be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition. The purpose of these checks is to detect and abate hazard.
- A body harness shall be worn and a lanyard or self-retracting lifeline attached to the boom or basket when working on an aerial lift.
- Employees must stand firmly on the floor of the basket. Do not sit or climb on edge of the basket. Planks, ladders, or other devices are not allowed to increase working height.
- The platform must be lowered and locked before positioning or repositioning the equipment.
- Additional guidance found in the manufacturer's operator's manual must be reviewed by the GEI employee.

1.5 Hazards - Electrocution

Nationally, one of the most common and deadly hazards associated with aerial lifts is electrocution from contact with electrical wires and conductors. ANSI and OSHA standards specify minimum safe distances that are to be maintained while working in an aerial lift, as indicated in the table below. If these minimum distances cannot be achieved, do NOT use the equipment.

Voltage	Minimum distance
< 50 KV	10 feet
50 - <199 KV	15 feet
200 – 349 KV	20 feet
350 – 499 KV	25 feet
500 – 749 KV	35 feet
750 – 1000 KV	45 feet

Other precautions to avoid an electrocution hazard include:

- If using electrified tools while on an aerial lift, use only tools that are double insulated or have a grounding plug.
- If using an electromechanical model lift, verify that the proper gauge of extension cord wire is used, that it is in good condition and equipped with a grounding plug and ground fault circuit interrupter (GFCI).
- Do not operate the machine outdoors if there is threat of lightening. Do not operate during inclement weather, including windy conditions, since fall and tip-over hazards are exaggerated in these conditions.

- Personnel on the ground are prohibited from operating the ground controls when an aerial lift is in contact with a live electrical source until such time as the electrical source is de-energized.

1.6 Hazards – Tip Over and Collapse

Tip-over and collapse are also serious hazards associated with aerial lifts, being the second leading cause of injury associated with aerial lifts. Reduce this hazard by observing the following precautions:

- Do not exceed the manufacturer's specified maximum load (which includes the weight of the person and all tools/supplies/equipment, etc. that will be on the platform).
- Do not operate on surfaces that exceed the manufacturer's maximum slope (typically 5 percent or less). Use wheel chocks and brakes when operating on any slope.
- Set up on a firm surface, well away from drop-offs.
- When navigating a lift that is designed to move with the platform extended, avoid debris, bumps, depressions, or potholes. Do not drive over floor grates or covers. Do not exceed the manufacturer's maximum speed recommendations.
- Know the type and proper usage of stabilizing mechanisms used on the lifts that you operate. Do not attempt to move or adjust stabilizing mechanisms while the platform is raised.
- Do not position or tie off the lift or platform against a wall, structure, or other surface.
- Maintain the intended center of gravity by evenly dispersing loads on the platform. Do not attempt to increase the surface area of the platform with planks, boards, or other devices. Do not let materials extend over the edge of the platform. Do not hang tools or equipment off the sides or rails of the platform.
- Exercise care when raising and lowering the platform to avoid entangling ropes, cords, etc. in the machine.
- Most aerial lifts are intended for a single person. Do not allow more than one person on a lift unless it is specifically designed for that purpose.
- Avoid horizontal forces from work tasks that could cause the platform to sway and become unstable. This includes pushing off or pulling toward any surface, structure, or object outside of the platform.
- Do not operate an aerial lift outdoors during windy conditions or other inclement weather. Check and comply with the manufacturers' recommendations of operation regarding wind speed limitations for operating the lift.
- Do not climb on the mast or use ladders or scaffolds on any part of the machine.
- Enter and exit the platform only through the intended access point/gate.

1.7 Hazards - Falls

Falling from a lift is another hazard that must be recognized and steps taken to mitigate the risk.

- A full-body harness personal fall arrest systems must be used when operating lifts.

- An approved fall restraint system will be attached to the boom or basket when working from an aerial lift and is not permitted to be attached to adjacent poles or structures.
- Restrict materials and equipment on the platform to that which can be safely handled by one person.
- Keep both feet firmly on the floor of the platform. Do not attempt to gain additional reach by standing on boxes, planks, or other objects.
- Do not lean on or over the rails. Do not sit, stand, or climb on the guardrails.
- Keep your boots clean and confirm that they have a good, anti-slip tread.
- Keep the platform clean and free of debris. Position equipment so that the weight is evenly distributed and in a manner that does not create a trip hazard.
- Enter and exit the platform only when it is fully lowered.
- If a platform or elevating assembly becomes caught, snagged, or otherwise prevented from normal motion by adjacent structures or other obstacles such that control reversal does not free the platform, personnel must be removed from the platform before attempts are made to free the platform using ground controls.

1.8 Hazards - Collision

Collision hazards can exist both overhead and on the ground. To avoid collision hazards:

- Lockout overhead cranes that are located within the working distance of the lift.
- Look below before lowering a platform to verify that persons or objects are not present. Give warning of your intent to descend (audible alarm, voice commands, etc.). If working as a team, verbally verify clearance of your teammate(s) on the ground before lowering.
- Avoid setting-up in high traffic areas. If absolutely necessary, attempt to conduct work at low-traffic times or work with appropriate personnel to temporarily interrupt traffic during the time that the lift is in use. Regardless of the traffic level, place warning barricades at a safe perimeter around the lift to detour both pedestrian and vehicular traffic.
- Be aware of the swing range. Set-up in a manner that avoids objects within the range of motion of the machine.
- When moving a lift, use extreme caution and slow and deliberate motions, particularly when space is limited, traffic is high, surface conditions are potentially hazardous (slippery, pot-holes, etc.), or the route contains corners, blind spots, and other visual obstructions.
- For drivable boom lifts, use the boom controls (not the drive controls) for final positioning of the platform close to objects.

1.9 Hazards - Entanglement

Obviously, any lift has many moving parts, which create pinch and/or shear points. To avoid injury from pinch/shear points:

- Keep hands, arms, and other body parts within the confines of the platform and guard rail while working on the platform. Keep hands and fingers away from moving parts while on the ground.

- Avoid loose clothing that could become caught in chains, pulleys, lifts, etc. Keep long hair confined.
- Verify that the machine is de-energized before conducting maintenance and repairs.

1.10 Improper Use

It is relatively simple to mitigate the risk of injury resulting from improper use.

- Remove the key or otherwise secure a lift while it is being stored so that it is not available to unauthorized persons.
- Do not allow anyone to operate a lift until they have completed instructional and hands-on training and they have demonstrated competency in the operation of the specific lift they are expected to use.
- No horseplay.
- Use an aerial lift only for the purposes and in the manner specified by the manufacturer.
- Do not use an aerial lift as a crane.

1.11 Hazardous Atmosphere

There are a number of things that must be considered with respect to potentially hazardous atmospheres. The first is the workplace atmosphere irrespective of the aerial lift. Aerial lifts are not intrinsically safe, meaning that they can create sparks that could ignite flammable vapors, fibers, or dusts that may be in the atmosphere. Under no circumstances should a lift be operated in a hazardous location (contains, or has the potential to contain, an explosive or flammable atmosphere).

While GEI does not have work sites that ordinarily would contain flammable vapors/dusts/fibers, it is important to recognize that an unusual condition could present such a hazard (e.g., leak/ruptured drum or tank for gasoline or other solvent, etc.) and this would negate the use of an aerial lift. Any entries into Permit Required Confined Spaces must be in compliance with GEI's Permit Required Confined Space program.

Another atmospheric hazard may develop from operation of certain lifts in unsuitable locations. For example, gasoline, propane, and diesel engines generate exhaust fumes (carbon monoxide and other pollutants) that can be hazardous to the operator and others. This is especially problematic when operating a combustion engine lift in areas that have insufficient ventilation. To avoid creating a hazardous atmosphere:

- Use electric powered units in confined areas.
- Install carbon monoxide detectors in use areas.
- Adhere to maintenance schedules to verify efficient fuel combustion.
- Remove a lift from service that does not appear to be operating normally.
- Clean up spills and leaks of fluids.
- Know the symptoms of exposure to carbon monoxide. Carbon monoxide is colorless and odorless- you can't easily detect overexposure through your ordinary senses. Rather, you

are likely to suffer symptoms such as shortness of breath, nausea, headache, or light-headedness at low to moderate concentrations. Prolonged or high exposures can lead to death. If you suspect an overexposure, seek fresh air. As needed, seek medical attention.

1.12 Defective Machines

Before an aerial lift can be used safely it must be in safe condition. The purpose of a pre-use inspection is to detect defects or damage that could impair the functioning of the machine or the operator's familiarity with the controls. If a defect is detected during the pre-use inspection, the machine must be returned to the equipment supplier with an explanation of the defect. Notify the Project Manager and the CHSO of the situation.

1.13 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate personal protection equipment (PPE) must be worn correctly to provide the intended level of protection.

1.14 References

29 CFR 1910.67 (Vehicle Mounted Elevating and Rotating Work Platforms)
29 CFR 1926.453 (Aerial Lifts)
29 CFR 1926.502 (Fall Protection Systems)
29 CFR 1926.20 (General Safety and Health Provisions)
29 CFR 1926.21 (Safety Training and Education)
American National Standards Institute (ANSI), A92.3, Manually Propelled Elevating Aerial Platforms
ANSI, A92.6, Self-Propelled Elevating Work Platforms
ANSI, A92.2, Vehicle Mounted Elevating and Rotating Aerial Devices
ANSI, A92.5, Boom-Supported Elevating Work Platforms

1.15 Attachments

None

1.16 Contact

Corporate Health and Safety Officer
East Region Health & Safety Officer
South Region Health & Safety Officer
Central Region Health & Safety Officer
West Region Health & Safety Officer

Appendix F

Community Air Monitoring Plan

GEI Consultants

Consulting
Engineers and
Scientists

Health and Safety Plan

Appendix F - Community Air Monitoring Plan (CAMP)

RG&E West Station Plant Area
Rochester, New York
Site No. V00593-8
Index No. B-0535-98-07

Prepared For:
Rochester Gas and Electric
Rochester, New York

Submitted by:
GEI Consultants, Inc., P.C.
90B John Muir Drive Suite 104
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September 2017

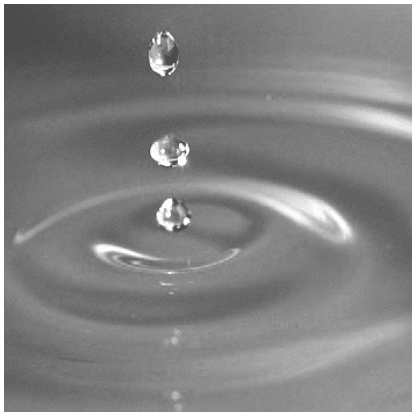

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Table of Contents

Tables

Abbreviations and Acronyms

CAMP	Community Air Monitoring Plan
COC	Compounds of Concern
GEI	GEI Consultants, Inc., P.C.
HASP	Health and Safety Plan
MGP	Manufactured Gas Plant
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAH	Polycyclic Aromatic Hydrocarbon
PID	Photo-ionization Detector
ppm	Parts per Million
RAWP	Remdial Action Work Plan
SVOC	Semi-Volatile Organic Compound
VOC	Volatile Organic Compound
$\mu g/m^3$	Micrograms per cubic meter

1. Introduction

This document presents the Community Air Monitoring Plan (CAMP) that will be implemented during the Remedial Action at the RG&E West Station Former MGP Plant Area Site located on Falls Street in Rochester, New York. A CAMP is required by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) at sites where ground-intrusive activities may result in airborne release of compounds of concern (COCs). This CAMP has been developed to monitor for total volatile organic compound (VOC) vapors, and for particulates (dust) which are the principal COCs resulting from intrusive activities performed during implementation of the Remedial Action Work Plan (RAWP) prepared for the Site.

The Remedial Action (RA) for the West Station Plant Area will initially consist of a pre-design effort, which will include:

- characterization of soil and sediments on the Genesee River side of the Site;
- limited excavation of soils adjacent to the existing concrete retaining wall to assess its integrity, and;
- exploratory soil borings completed along the alignment of a new concrete barrier wall to be constructed during the implementation of the remedy.

Information derived from pre-design information will be used to guide the implementation of the remedy which will include;

- excavation, stabilization/dewatering and disposal of Genesee River sediments and river-side soils;
- Removal of former processing piping associated with the former MGP;
- Excavation and disposal of land-side soils;
- Construction of a new concrete barrier wall which will tie into the existing concrete barrier wall;
- Installation of DNAPL recovery wells, and;
- Placement of a 12-24” thick cover soil across the Site.

The objectives of this CAMP are to:

- Ensure that the airborne concentrations of COC are minimized to protect the community.

- Provide an early warning system so that potential emissions can be controlled on site at the source.
- Measure and document the concentrations of airborne COC to confirm compliance with the specified limits.

This CAMP is a companion document to GEI's site-specific Health and Safety Plan (HASP) which is directed primarily toward protection of on-site workers within the designated work zones.

2. Air Monitoring Equipment, Methods, and Action Levels

This section provides instructions for conducting the CAMP. Discussed are the COCs to be monitored, the equipment to be used, and the action limits. Community air monitoring will be performed for total VOCs and particulates (dust) during the excavation and backfilling activities performed at the Site.

In addition to the community air monitoring, work/exclusion zone monitoring will be performed during work activities where impacted soil may be encountered. The exclusion zone air monitoring requirements, equipment, and action levels are described in the site-specific HASP for this project. Note, however, that the work zone air monitoring and the community air monitoring are conducted as part of the overall site control program. When work zone VOC or particulate readings are found to exceed the downwind CAMP limits, the field staff will check the upwind and downwind air monitoring instruments to assess whether control measures will be required.

2.1 Monitoring Locations

Air monitoring locations will be established at the start of each workday. A minimum of one station located upwind of the work area, and one located downwind of the work area/exclusion zone will be placed at the Site perimeter as determined by the prevailing wind direction at the start of the day. The purpose of the upwind station will be to determine the background concentration of VOCs and particulates at the worksite. The downwind monitoring station will be used to assess compliance with the NYSDEC/NYSDOH specified action limits for VOCs and particulates. The upwind VOC and dust measurements will be subtracted from the downwind measurements in order to compare the downwind instrument readings to the CAMP action levels. Additionally, a station will be placed on the Pont de Rennes pedestrian bridge at the south end of the Site to monitor air quality near potential receptors at the upper rim of the Genesee River Gorge.

The location of the each monitoring station will be noted on a Community Air Monitoring Daily Data Sheet. The locations of the instruments may be changed during the day to adapt to changing wind directions. Each location will be noted on the Daily Data Sheet, along with the start and stop time at each location. Field personnel will be prepared to move the equipment to multiple locations in the event that there is little wind, if the wind direction changes frequently, or if there is a change to the location of the most sensitive downwind receptor location.

It is not anticipated that any work area will be within 20' of any occupied structure during implementation of the RAWP. However, if any work area is less than 20 feet from the nearest occupied building, a downwind air monitoring station will be positioned at the air intake for the building or at the most sensitive exposure point for the downwind receptors. Background measurements inside the building will be made prior to the start of work. If exceedances of the action levels are measured at the outside wall of the building, additional measurements will be made inside the building using portable meters.

If necessary, precautions to minimize the release of VOCs and particulates will be taken at the work zone, and engineering or work controls used to protect the downwind receptor. These controls for minimizing releases from the work zone are discussed in Section 3.

2.2 Air Monitoring Equipment

The monitoring instruments will be calibrated at the start of each workday, and again during the day if the performance of an instrument is in question. The time and method of calibration will be noted on the Daily Data Sheet. Both the photo-ionization detectors (PIDs) and particulate meters will be mounted on a tripod in a vented protective case, and programmed to record 15-minute averages. A monitoring technician will check the instrumentation at each of these locations regularly during the workday to ensure that they are operating properly.

2.2.1 VOC Monitoring Equipment

VOC monitoring will be performed using PIDs (RAE Systems MiniRAE™ or equivalent) equipped with a 10.2 or 10.6 eV bulb. The instruments will be set to record 15-minute running average concentrations. The PIDs will be equipped with an audible alarm to indicate an exceedance of the action level of 5 ppm total VOCs.

2.2.2 Particulate (Dust) Monitoring Equipment

Particulate monitoring will be performed using meters set to measure 10 micron and finer particulates (PM-10). Particulates will be monitored using an MIE DataRAM DR-2000l, TSI DustTrak™, or equivalent, which is capable of measuring PM-10. The equipment used will be set to record 15-minute running average concentrations, for comparison to the action levels.

In addition to the instrument readings, fugitive dust migration will be visually assessed during all work activities, and the observations recorded. Per NYSDEC requirements, visible dust migration will not be allowed. If visible dust is observed to be migrating from the work zone, the work will be stopped and dust control measures implemented.

2.3 Monitoring Action Levels and Responses

The action levels and responses for VOCs and particulates are presented in Table 1.

Table 1. Air Monitoring Response Levels and Actions

VOCs	
Response Level	**Actions**
>1 ppm at the wall of an occupied structure or at an air intake	▪ Check the indoor air concentration and compare with background measurements taken previously
>5 ppm above background for 15-minute average	▪ Temporarily halt work activities ▪ Continue monitoring, especially inside of occupied structures ▪ Perform work during cold weather ▪ If VOC levels decrease (per instantaneous readings) below 5 ppm over background, work activities can resume
Persistent levels >5 ppm over background but <25 ppm	▪ Halt work activities ▪ Identify source of vapors ▪ Corrective action to abate emissions ▪ Continue monitoring ▪ Resume work activities if VOC levels 200 feet downwind of the property boundary or half the distance to the nearest potential receptor is <5 ppm for a 15-minute average
>25 ppm at the perimeter of the work area	▪ Shut down work

Particulates	
Response Level	**Actions**
>100 µg/m^3 above background for 15-minute average or visual dust observed leaving the site	▪ Apply dust suppression ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site
>150 µg/m^3 above background for 15-minute average	▪ Stop work ▪ Re-evaluate activities ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site

Sources:

- NYSDOH Generic Community Air Monitoring Plan, December 2009, as published in NYSDEC DER-10, Appendix 1A, 2010.
- Fugitive Dust and Particulate Monitoring, NYSDEC DER-10, Appendix 1B, 2010.
- Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures, NYSDOH.

All data will be downloaded to a computer on a daily basis and saved for review. The data will be provided to the NYSDEC and/or the NYSDOH upon request at any stage of the project.

If VOC or particulate action levels are observed to be exceeded during the workday, the event, the source, and corrective actions taken will be recorded on the Daily Data Sheet and reported to the on-site NYSDEC representative, if present. If an on-site representative is not present, exceedances will be noted in the daily report to the NYSDEC project manager within one business day.

Table 2. Emergency Contacts and Telephone Numbers

Fire, Police, Ambulance		911
NYSDEC Contact	Keith Gronwald, P.E. – Project Manager	(office)
RG&E Contact	Christopher Keipper – Project Manager	(585) 771-4560 office (585) 363-3204 cell
RG&E Emergency	Outage Central Natural Gas Emergency	1-800-743-1701 1-800-743-1702

2.4 Odor Monitoring

The field personnel will record observations of odors generated during the implementation of the Remedial Action Work Plan (RAWP). Odors will be recorded as weak, moderate, or strong, based on olfactory responses. When odors attributable to the exposing of impacted media are generated in the work area during excavation, observations will also be made at the downwind limit of the Site. The observations will be made to assess the potential for significant odors reaching on-site receptors or being transmitted off site. The downwind odor monitoring will be performed in conjunction with the PID and dust monitoring program described in this CAMP.

Upon detection of strong odors at the site perimeter, site controls, starting in the work area, will be implemented. The site controls described in Section 3 will be used to assist with odor mitigation. Note that the goal of the Odor Management Plan is to minimize and to prevent, where practicable, the off-site migration of odors. Due to the short distances between some work areas at the site and the property lines of on-site receptors, site controls may be implemented proactively when odors are detected in the breathing zone in some work areas.

There are no action levels specified for odors. In the event that odors persist at the downwind receptors or property line after control measures are carried-out, the odor conditions will be discussed with the RG&E and NYSDEC project managers.

3. Control Procedures

A dust, odor, and organic vapor control and monitoring plan (DOOVC Plan) will be developed for on-site remedial construction work activity that will meet CAMP requirements and OSHA standards for construction (29 CFR 1926) after selection of the final remedy. The DOOVC Plan will specifically address work practices to minimize dust, odors and vapors during all remediation construction activities.

4. Documentation and Reporting

A Daily Data Sheet will be filled-out each day to record all of the details of the CAMP work. The form will be used to record the following information:

- Date and weather, with significant changes noted which may affect the positioning of the meters or recording of the data.
- Calibration results for the instruments.
- Locations of the upwind and downwind monitoring stations, and any changes made to the locations during the day to adjust for changing work locations or wind directions.
- Any significant readings made during the day, such as exceedances which occur and their causes.

Additional information will be noted in the project fieldbook(s), as necessary.

The electronic measurements from the PIDs and dust meters will be downloaded each day, reviewed, and archived. Exceedances of the action levels, if any, and the actions to be taken to mitigate the situations, will be discussed immediately with the on-site representatives, or reported within one business day to the NYSDEC project manager (if on-site NYSDEC oversight is not provided). The results of the daily CAMP monitoring will also be discussed in the daily written report to the NYSDEC project manager. Summaries of all air monitoring data will be provided to the NYSDEC or the NYSDOH upon request.

CAMP odor monitoring results will be recorded in the field log book and/or the Daily Data Sheet, and will also be available for review by the state agencies.

Appendix C

Technical Bulletin - Guidelines for Sampling Bed Material

Technical Supplement 13A

Guidelines for Sampling Bed Material

(210–VI–NEH, August 2007)

Issued August 2007

Cover photos: *Top*—Bed-load sediment may be poorly graded or well graded. Armoring layers may also be present.

Advisory Note

Techniques and approaches contained in this handbook are not all-inclusive, nor universally applicable. Designing stream restorations requires appropriate training and experience, especially to identify conditions where various approaches, tools, and techniques are most applicable, as well as their limitations for design. Note also that product names are included only to show type and availability and do not constitute endorsement for their specific use.

Technical Supplement 13A

Guidelines for Sampling Bed Material

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Technical Supplement 13A

Guidelines for Sampling Bed Material

Purpose of bed-material sampling

The characteristics of a given stream are linked to the composition of the material that comprises its channel bed, bank, and sediment flow. Knowledge of streambed material is necessary for a variety of engineering and environmental purposes. The size and gradation of the streambed material may affect the source, transport, and fate of pollutants; fish habitat; resource management; morphological trends; and stream restorations.

Bed-material sampling programs must be carefully designed to meet the particular needs of a specific study. Studies may include objectives related to the following:

- Contaminants—Typically attach to cohesive sediment and, therefore, are distributed over a wide area, especially in areas where flow velocity is low. Sampling for a contaminant concentrates on depositional zones in the stream and overbank.
- Aquatic habitat—Fish habitat studies may focus on the suitability of the streambed for spawning. Sampling for this type of study is often extensive, identifying lateral, longitudinal, and temporal variations in the surface layer over a wide area of the stream. An assessment of vertical variations may also be of critical importance, as the composition of the material immediately below the surface, especially the fines content, may be of importance in the evaluation of spawning habitats for some species.
- Gravel mining—Resource management studies are frequently concerned with the need or feasibility of sand and gravel mining. Core or substrate sampling that identifies vertical variation of the streambed is essential for this type of study.
- Stream assessment and design—Morphologic and engineering studies are concerned with changes in the character of the river over time. These studies require knowledge of the grain size distribution of both the bed surface material and subsurface material for sediment transport calculations, critical shear stress determinations, determining potential for particle sorting and armoring, and determining hydraulic roughness.

Complex studies may need to secure data to meet a combination of objectives and purposes. However, sediment data collected for one purpose will not necessarily be applicable for another. While the issues and recommendations presented here are generally applicable, the focus is on bed sampling for stream assessment and design.

Site selection for representative sampling

Sufficient sampling of the streambed should be conducted to determine the spatial variability, size, and gradation of the bed material. No simple rule exists for locating representative sampling sites or reaches. The general rule is to carefully select sampling locations and avoid anomalies that would bias either the calculated sediment discharge or the calculated bed stability. Sampling locations must be representative of the hydraulic and sedimentation processes that occur in that reach of the river. The site should be morphologically stable. To ensure data reflect reach-averaged river conditions, there should be no tributary inflow in the proximity of the site, as it may interfere with the homogeneity of the section by supplying sediment for deposition. The site should not be located adjacent to a zone of active bank erosion, as the material deposited in the channel near the eroding area may not be representative of the reach. Although bridges provide good access, bridge crossings are typically not appropriate sampling sites because either they are located at natural river constrictions or their abutments and piers create constrictions and local scour. Dead-water areas behind sand bars or other obstructions should be avoided, as these are not representative of average flow conditions.

The location of the bed sample should be chosen with the target analysis in mind. Table TS13A–1 provides guidance for where a bed-material sample might be taken as a function of the type of geomorphologic or engineering analysis to be conducted. This list is not inclusive, exhaustive, or absolute. Ideally, bed-material

samples should be taken at different times during the year to account for seasonal variations.

Sand-bed streams

Sand-bed streams have relatively homogeneous bed-material gradation. Vertical and temporal variability are normally insignificant in stable sand-bed streams. Longitudinal variability typically occurs over distances of many kilometers. However, lateral variability, especially in bends, can be significant. In sand-bed rivers, sampling of bed material is most frequently done in the low-flow channel. The sampling equipment and methodology used depend on the river depth and velocity. The task can be accomplished in flowing streams either by wading or from a boat or in ephemeral and intermittent streams in the dry. Vertical variations in the bed material are usually insignificant in flowing water, and samples are collected from the surface. However, in standing water or on dry beds, a layer of fine material is sometimes found deposited on the bed surface during the recessional part of a flood hydrograph. It is standard practice to remove this fine surface layer before collecting a bed-material sample in this location.

Einstein (1950) recommended using only the coarsest 90 percent of the sampled bed gradation for computations of bed-material load. He reasoned that the finest 10 percent of sediment on the bed was either material trapped in the interstices of the deposit or a lag deposit from the recession of the hydrograph and should not be included in bed-material load computations.

Representative bed-material sampling in sand-bed streams may be accomplished by one of two methods. Employing the cross-sectional approach requires selecting a site and time for sampling where and when the bed characteristics are typical. This method requires considerable experience. Unanimity of opinion about where and when the typical condition occurs cannot be expected, even among experienced river scientists. Frequently, judgment is influenced by the type of streams the sampler has experienced and by the intended use of the data. Employing the reach approach, where samples from several systematically selected cross sections are averaged to obtain a representative sample, may eliminate some uncertainty associated with the cross-sectional approach.

Cross-sectional approach

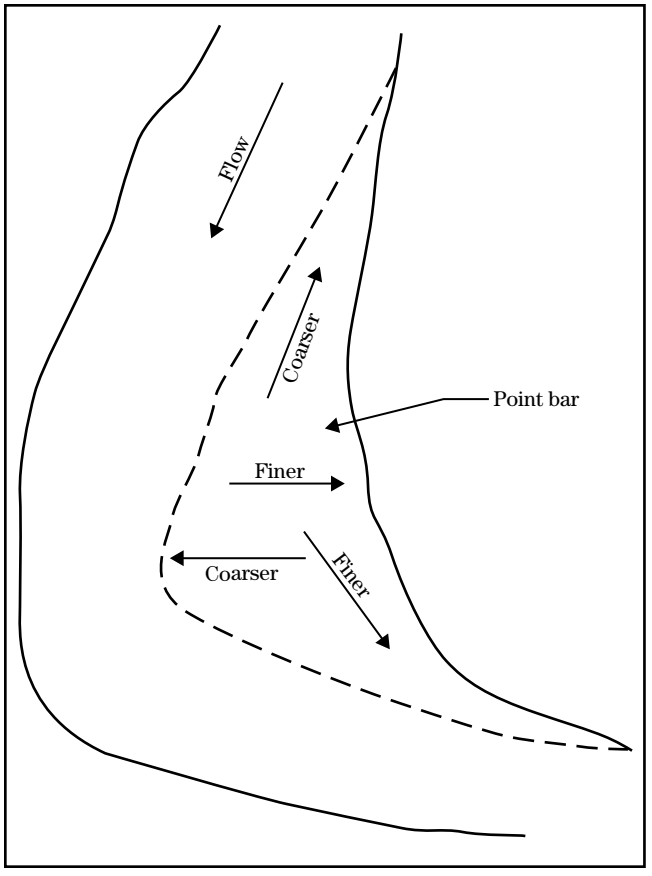
This approach requires the selection of a representative cross section for a reach. In streams with relatively uniform depths, between three and five samples should be taken across the section to account for lateral variations. In streams with variable depths, more samples are required. Twenty verticals are commonly taken along the cross section in braided streams. Taking bed-material samples at crossings where flow distribution is more uniform reduces the lateral variation in the samples. However, at low flow, crossings may develop a surface layer gradation that reflects sediment transport conditions at the lower discharge, which may be coarser or finer than the bed gradation at bankfull discharge. Also, crossings are typically submerged, and more elaborate sampling equipment is required than at exposed bars, where a

Table TS13A–1 Bed-material sampling sites

Purpose of analysis	Sample location
To estimate the maximum permissible velocity in a threshold stream	Riffle
To estimate the minimum permissible velocity in a threshold stream	Areas of local deposition
To estimate sediment yield for an alluvial stream	Crossing or middle bar
To quantify general physical habitat substrate condition	Bars, riffles, and pools

shovel is usually a sufficient sampling tool. However, samples collected on a point bar or alternate bar may exhibit considerable variation. Figure TS13A–1 illustrates typical bed-material gradation patterns on a point bar. Note that although the typical grain sizes found on the bar surface form a pattern from coarse to fine, no single sampling location always captures the precise distribution that represents the entire range of sedimentation processes.

Figure TS13A–1 Gradation pattern on a point bar



Reach approach

An alternative to the cross-sectional approach is the reach approach. A reach is defined as a portion of the stream with similar morphology (identified by its homogeneity). Generally, five cross sections are laid out in the homogeneous reach. If there is a gage in the reach, locating the center cross section near the gage is preferred. This facilitates relating the sediment data to measured hydrologic and hydraulic data. If the stream reach is straight, the spacing of the cross sections should be approximately two to five stream widths, and if the reach is meandering, the spacing should occur within one meander length (fig. TS13A–2). The same criteria used in the cross-sectional approach to determine the number of verticals to take along each section are applied here. The reach approach applies best to rivers with meanders of different wavelengths and amplitudes.

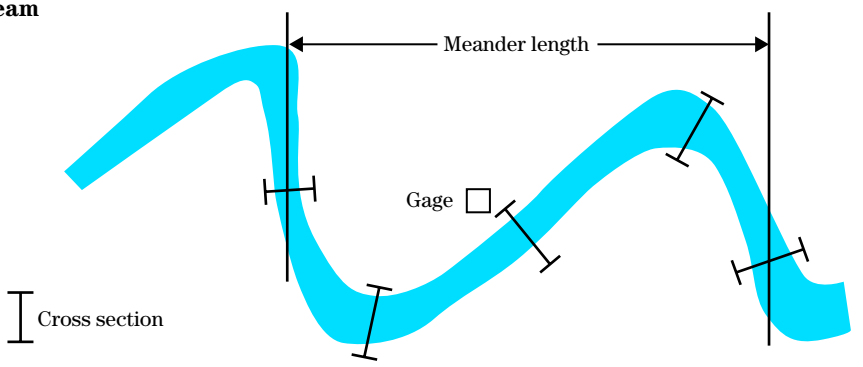
Gravel-bed streams

Coarse beds (gravel, cobble, and boulder) are characterized by significant vertical, spatial, and temporal bed-material variability. A vertical stratification in the bed material can be formed as the finer material is winnowed from the surface. A sketch of the resulting sediment profile is provided in figure TS13A–3. Another distinctive characteristic of gravel-bed streams is a coarse surface layer that may form in both the low-flow channel and on bars. Frequently, the low-flow channels of coarse bed streams are armored with large cobbles and boulders, while bars consist primarily of sand and gravel.

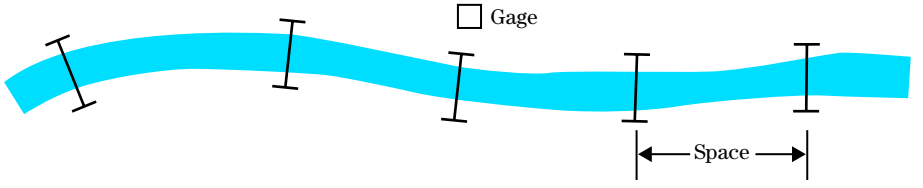
Since the spatial variability in most coarse bed streams is high, securing representative samples is difficult. River bars are frequently chosen as sampling sites because they are considered the most representative of the sediment moving in the stream, and they are usually dry during sampling. Specific bar types have been determined to be more representative than others. A bar type hierarchy established to aid site selection (Bray 1972; Yuzyk 1986) is shown in figure TS13A–4. Mid-channel and diagonal bars are most ideal sampling sites because they are exposed to the highest velocities, which transport the largest materials. Point bars are not as ideal because velocities are highly variable,

Figure TS13A–2 Bed sampling locations for sand-bed streams

Meandering stream



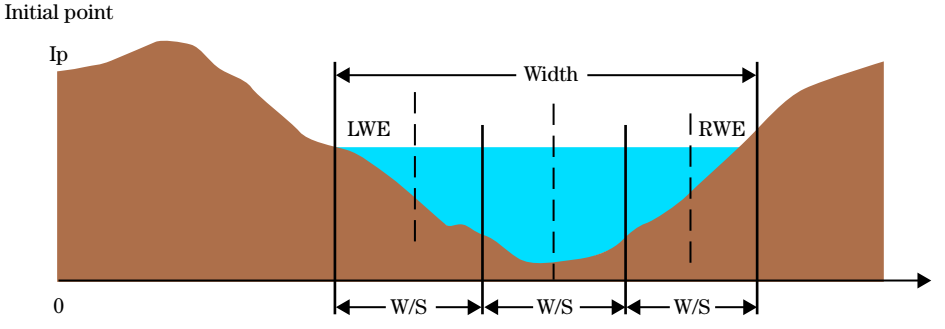
Straight channel



Space = 2 to 10 channel widths

Cross section

Panel widths=1/3 to 1/5 width of channel (W)
Sampling locations—centroid of each panel



decreasing toward the inside bank. Channel side or lateral bars are least desirable because they exist in zones of low velocities due to boundary and bank effects. In small streams with no bars and a pool-riffle sequence, the riffles may be sampled to characterize bed-material size. However, the bed material in a riffle is normally much coarser at low flow, when sediment transport is typically negligible, than at bankfull flow when sediment transport is active.

Based on the assumption that the coarsest materials in the bed exert the predominant effect on channel behavior and flow resistance, some practitioners recommend that samples be collected at the upstream end of a bar (Bray 1972; Church and Kellerhalls 1978; Yuzyk 1986). Sediments at this location are indicative of the sediments in the main channel, are readily identifiable, and generally exposed. The upstream end of a bar usually consists of the coarsest material in the channel and not the average size in the reach. This is because the upstream end of a bar is the location most frequently exposed to the highest stream velocities.

Finally, it is helpful if the bed-material sampling location is near a stream gaging station to better relate the sampled sediment data to measured hydrologic and hydraulic data.

Figure TS13A–3 Gravel-bed sediment profile showing vertical variation

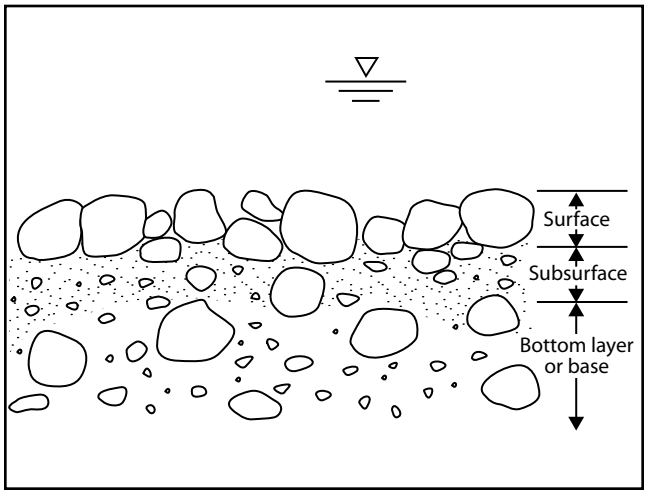
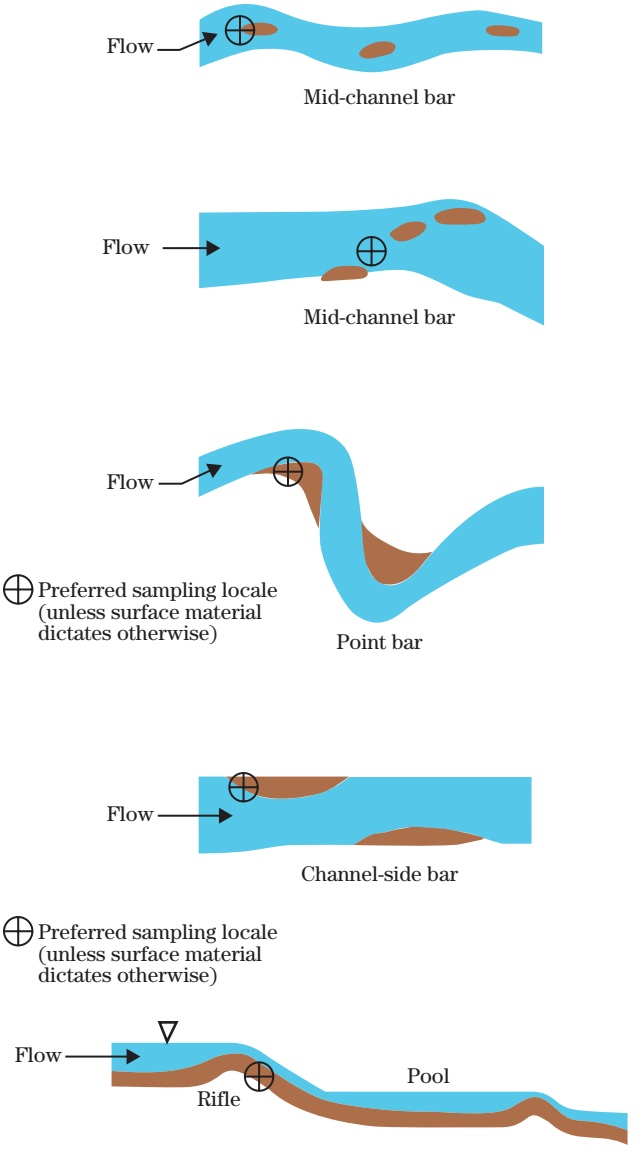


Figure TS13A–4 Coarse bed stream sampling hierarchy



Surface sediment sampling

Bulk or volumetric sampling is generally considered to be the standard sampling procedure. It involves the removal of a predetermined volume of material large enough to be independent of the maximum particle size. In general, the minimum depth of a volumetric sample should be at least twice the diameter of the maximum particle size, and the minimum weight should be 200 times the weight of the largest particle of interest (Diplas and Fripp 1992). This can lead to unrealistically large samples for many gravel-bed streams, and extrapolation may be necessary. The sample is then sieved, and the analysis is interpreted as a grain size frequency distribution by weight.

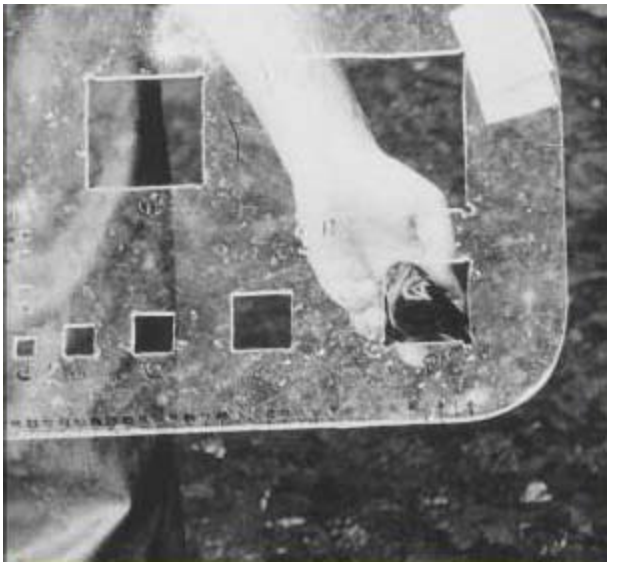
As previously noted, in coarse or gravel-bed streams, the top layers may be stratified by size due to armoring effects. Typically, bulk sampling is employed to characterize the subsurface or base layers. However, to quantify the particle size of the surface, a surface sampling technique is typically used.

Surface or areal-surface sampling is used to characterize the surface of a gravel bed. This coarse surface layer correlates to such important characteristics as hydraulic roughness, critical shear stresses, armoring, and sediment transport. A common methodology for surface sampling is a pebble count (Wolman 1954), where individual particles are collected at random by hand, and the intermediate axis is measured. The random walk method devised by Wolman can easily be employed on a dry bed or in wadeable flow, and with more difficultly by divers in deeper water. To obtain a sample, a team member paces along a selected path, stopping to collect a pebble with each step. The pebble is selected with closed or averted eyes. Other forms of this sampling include laying out a linear tape and selecting the pebble at a designated interval, laying out a preconstructed rectangular grid, and selecting the pebble at grid point intersections. The spacing of the sampling points must be at least two times the diameter of the largest particle in the sampling area. This reduces the influence of nearby particles.

At least 100 particles should be included in the hand-collected surface sample. However, to be very precise or to accurately measure small percentiles, the number of sampled particles should be increased. For example, if the D_{10} and D_{90} size fractions are of importance, the sample size should consist of at least 200 stones (Fripp and Diplas 1993). The gradation curve developed from these data is based on the number of particles in each size class, not their weights or projected surface areas. However, the resulting gradation curves are identical to those developed using sieve analysis because the selected particles all represent the same surface volume, and therefore, the same weight. The measuring process may be streamlined in the field by using a gravelometer or template (fig. TS13A–5) with standard sieve sizes to measure the sieve diameter of each particle immediately after the particle is selected. The sieve diameter for each particle is recorded as the maximum size of the opening on the template that the stone will not fit through.

Studies have shown that particles smaller than 2 millimeters are typically missed, and particles below 8 millimeters are underrepresented with Wolman or hand-based surface sampling (Fripp and Diplas 1993). This truncation is especially prevalent if the bed surface is submerged. When a sizable fraction is missing or underrepresented, the percentage of the remaining size fractions is increased, and the distribution

Figure TS13A–5 Gravelometer held above stream



becomes biased towards the larger sizes. Even gross measurements, such as median grain size, can be affected. As a result, the use of the sampled distribution can result in erroneous results. Typically, adhesive-based areal sampling is required to accurately sample surface particles.

Adhesive surface sampling uses clay, tape, or wax to remove the surface particles. Clay is generally preferable for underwater sampling. The plans for a typical clay sampling device are shown in figure TS13A–6. The clay is placed on the piston and pressed firmly onto the gravel bed. It is then drawn up into the cylinder so that the sample is protected from the stream flow as it is brought to the surface. The clay and sample material are then removed, washed to free the clay, and the sample is then sieved. The analysis is interpreted as a grain-size frequency distribution by weight.

In general, the minimum areal sample should be 100 times the area of the maximum particle of interest (Diplas and Fripp 1992). It is important to note that areal samples, which are interpreted by weight, are not directly comparable to volumetric samples, as they are biased in favor of the coarser sized material (Kellerhals and Bray 1971). The equation for converting a clay-based areal sample to its volumetric equivalent is provided below:

$$P(V-W)_i = Cp(S)_i D_i^{-1} \qquad \text{(eq. TS13A–1)}$$

where:

$P(V–W)_i$ = percentage of the frequency distribution by weight obtained for volumetric sampling

$p(S)_i$ = percentage obtained from the areal/surface sampling technique

D_i = mean diameter between size interval i and i+1

C = a proportionality constant that is unique for each sample and is calculated as

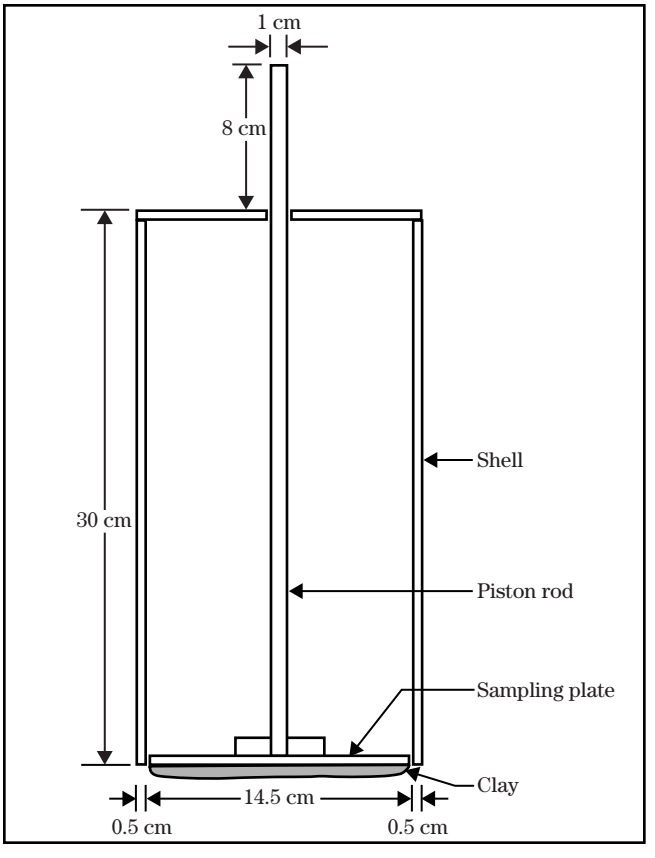
$$C = \frac{1}{\sum p(S)_i D_i^{-1}} \qquad \text{(eq. TS13A–2)}$$

Techniques for converting the material from various types of areal samples into equivalent volumetric samples are described further in Proffitt (1980); Diplas and Sutherland (1988); and Diplas and Fripp (1992).

Adhesive sampling using clay is typically limited to particles which are smaller than 40 millimeters in size (Diplas and Fripp 1992). If clay areal sampling is applied to samples containing larger material, the clay will not consistently attach to the larger size fraction, and the sample will be biased towards the smaller size fractions. Truncation can limit the obtained information and also bias the distribution.

The problem with truncation of either the smaller sizes (resulting from hand-based techniques) or the truncation of the larger sizes (as occurs with adhesive techniques) can be overcome with a combination of the two approaches. Results from an adhesive areal sample can be combined with the results of a pebble count, where the bed gradation influences significant

Figure TS13A–6 Piston sampler



amounts of both coarse and fine size fractions of material. This is done by matching the percentages where the two samples overlap. This is typically between 15 and 40 millimeters. More detailed information on this approach can be found in Fripp and Diplas (1993).

Sediment intrusion into spawning gravels

Sediment intrusion into the bed of gravel streams is an important ecological issue, as it can adversely affect fish reproduction. Sands, silts, clays, and organic matter that are deposited in gravel spawning beds, referred to as redds for salmonids, can adversely affect egg survival. The clogging of gravel beds by sands, fines, and organic matter reduces the availability of dissolved oxygen needed by salmonid embryos and fry. These deposits also restrict intergravel flows that are necessary to remove toxic metabolic wastes produced by incubating salmonid eggs. As a result, there is a need to quantify the degree of fine sediment and organic matter intrusion in gravel-bed streams.

One way to assess sediment intrusion into spawning gravels is to conduct freeze-core sampling over time (Rechendorf and Van Liew 1988, 1989). This sampling technique can be conducted for salmonids in an artificial redd built into the streambed prior to salmonid spawning. The artificial redd is constructed by excavating a depression 12 to 18 inches into the stream bed. The bottom of the depression is then lined with colored rocks or marbles. It may also be advisable to place a 2- to 3-inch piece of lead in the bottom of the hole so that a metal detector can be used to locate the site. A weighted piezometer is inserted on the floor of the depression. The piezometer can be a perforated copper pipe cast inside a Dixie® cup-sized piece of concrete, with a plastic tube on top. The plastic tube is corked and held up while the hole is backfilled. The backfilling is done by waving a shovel back and forth (winnowing) along the bottom of the channel upstream of the excavated hole. Upon movement of the backfill material upstream of the artificial redd, a small trough remains above the redd. This helps to establish flow into the upstream side of the artificial redd. This process is repeated across the stream, as well as upstream and downstream. The result is that three rows, each containing three artificial redds are constructed.

After the artificial redds are constructed and their location documented, a freeze-core sample should be taken. This should be done as soon after construction as possible to represent the prespawning clean redd condition.

Freeze-core sampling involves installing three metal probes (preferably copper) into the streambed and then freezing the rods. It is often necessary to divert high velocity water around the sample site. A 5-gallon bottomless bucket is then worked a few inches into the streambed at the sample site. The metal rods are then driven 12 to 18 inches into the bed in a triangular pattern within the bucket. The rods should be 3 to 6 inches apart. A tether to a bottle of compressed carbon dioxide is placed to each copper rod, and the rods are frozen for approximately 20 minutes. A heavy aluminum tripod is then placed over the bucket, and a winch is used to remove the frozen sample from the streambed.

The frozen sample should be placed in a box with adjustable separators so that depth increments below the surface can be established. As the sample thaws, the material will fall into the compartments. The bottom of the artificial redd is established by colored rocks or marbles. Each depth increment can then be dried and sieved. Stream freeze-core sampling is repeated with one sample at each location, progressively through the sediment runoff season. Periodic dissolved oxygen measurements can be made by extracting water through the piezometer. More information on the use of this technique can be obtained in Castro and Reckendorf (1995).

Selection of a sampling procedure

Several factors influence both sampling site selection and sampling procedure. The most significant factor is the data necessary to meet the objectives of the study at hand. The objective of a bed-material sampling program may be to determine a representative bed gradation for a particular reach of a stream, or it may be to determine the variability and diversity of the sediment bed. Data needs should be clearly defined before the sampling program is planned. The second factor to consider is field conditions. Different samplers and sampling procedures are appropriate for different environments. Therefore, it is necessary to know the

general streambed characteristics before the sampling program is established. Such reach-specific questions need to be addressed such as:

- Will the bed of the stream be wet or dry?
- Is the site accessible by road, boat, trail, or only by helicopter? Field conditions will determine both the practicality and type of sampling equipment to be used in the sampling program.
- What is the nature of the bed material to be sampled? Sand-bed streams typically have a more uniform bed gradation and therefore require a smaller volume sample than gravel-bed streams. Typically, equipment appropriate for sampling sand-bed streams is inappropriate for gravel-bed streams.

Once these physical issues are assessed, the available resources must be considered as a limiting factor when establishing a bed sampling program. Equipment, manpower, and funds are frequently limited, and therefore, priorities must be established.

Step-by-step field sampling procedures

Step 1 Select and mark out the required cross sections and the sampling locations. Use as many of the site-selection criteria outlined above as possible. The fixed permanent initial point should be on the left bank (looking downstream). Establish the control (horizontal and vertical) and reference all points.

Step 2 Sketch the site on data forms and reference the control points. If the streambed contains a mixture of sand and gravel deposits, map areas and record deposits of different size material. Develop a sampling strategy that will sample each zone.

Step 3 Collect a photographic record of the reach, controls, cross sections, sample locations (if possible), bed material (use a scale for reference), and bank conditions.

Step 4 Select appropriate sampler for the task (based on depth, velocity, and sample requirements). Verify that the sampler is operational.

Step 5 Collect sample as follows*:*
Surface bulk sample: sand bed. Move to a sampling location. In shallow streams, use a tape to measure from the permanently fixed initial point (IP), and wade to a sampling vertical on the section. Approach the sampling verticals from the downstream side to prevent disturbing the bed at the sampling section. In deep streams, using a boat and some type of positioning system (tag-line in narrow streams, electronic distance measurement (EDM) in wide streams), hold the boat steady over the sampling location. Obtain a sample of about 250 grams at each chosen location using the selected sampler.

Surface areal sample: coarse bed. To obtain a surface areal sample in a coarse bed stream, several techniques are employed. These can include random walks, setting up square or linear grids, or removing all the surface particles within a specified area. Hand-based techniques are typically employed, but they can be biased towards the larger size fractions. Collecting the entire surface layer within a specified area generally requires a specialized sampler.

Surface bulk sample: coarse bed. To obtain a surface bulk sample, carefully remove and collect all sediment in the surface layer to a thickness of the intermediate axis of the largest particle in the area. Care should be taken to ensure that fine sediment is not washed out of the sample. The required sample mass is a function of the largest particle.

Subsurface bulk sample: coarse bed. If the surface layer has not already been removed, then scrape away the surface layer of coarse material to the thickness of the intermediate axis of the largest particle in the area. The required sample mass is also a function of the largest particle.

*Step 6 (*Field sieving—this step is an alternative to transporting large bulk samples to a laboratory.) Set up a weighing station. This may consist of a tripod with a scale suspended for weighing pails of material. Assemble field sieve sets, and insert correct sieves. Collect pails, spades, template, labels, field note forms, sturdy plastic bags, and tarpaulins. Spread out two tarpaulins. Obtain tare weights for the pails. Shovel subsurface material into pails, weigh, and record. Pour material

into top of the field sieves (8, 16, 32, 64, 128 mm sieves). Rock and shake the sieve set until material has moved to its retained size sieve. Weigh material retained on each sieve and on the pan. Record the results in the field notes. Save the material passing the finest sieve size for laboratory analysis. Save the 10 largest particles. Repeat the process until the required mass has been sieved. Measure the three perpendicular axes of the 10 largest particles. Retain up to 10 kilograms of the combined material from the pan and discard the rest of the sample.

Step 7 Complete and attach a label and sediment field note form for each sample. Specify the stream, station, cross section, vertical location, date, time, bedform and flow conditions, personnel on crew, type of sampler, sample number, and sample depth.

Other bed-material characteristics

While deposited bed material is often characterized by grain size, other characteristics can be of concern, as well. Such particle characteristics include shape, specific gravity, lithology, and mineralogy. In addition, data that describe the distribution of the various particles sizes and of specific contaminates are frequently required. Characteristics of the sediment deposit itself include: stratigraphy, density, and compaction. For some of these purposes, a sample can be disturbed; others require undisturbed sampling.

When the sediment particles are noncohesive, mechanical forces dominate the behavior of the sediment in water. The three most important properties that govern the hydrodynamics of noncohesive sediments are particle size, shape, and specific gravity. A discussion of these properties is found in Sedimentation Investigations in Rivers and Reservoirs, EM 1110–2–4000 (U.S. Army Corps of Engineers (USACE) 1995c). The boundary between cohesive and noncohesive sediments is not clearly defined. It can be stated, however, that cohesion increases with decreasing particle size for the same type of material. Clays are much more cohesive than silts. Electro-chemical forces dominate cohesive sediment behavior. The three most common clay minerals that have electro-chemical forces causing individual particles to stick together are illite, kaolinate, and montmorillonite. The dispersed particle fall velocity, flocculated fall velocity of the suspension, clay and nonclay mineralogy, organic content, and cation exchange capacity characterize cohesive sediment. The fluid is characterized by the concentration of important cations, anions, salt, pH, and temperature. More detailed information is presented in Tidal Hydraulics, EM 1110–2–1607 (USACE 1991c).

Bank material

Many channel stability issues result from a combination and interaction of a number of different causes. These causes can include not only fluvial erosion forces but also seepage problems, as well as properties of the soil. In addition, the bank material can help define the stability of the channel section and may be responsible for a significant percentage of the total sediment load. Therefore, it is often important to determine the characteristics of the stream bank. This is often done coincident with the bed-material sampling. More information on issues related to the assessment and analysis of bank material is provided in NEH654.09.

Conclusion

Bed-material sampling is frequently conducted to make sediment transport calculations. For this purpose, the sampling program should identify not only a representative bed-material gradation, but also any lateral, longitudinal, vertical, and/or temporal variation in bed-material composition. Water depth, velocity, and bed-material size are the most important factors used to identify appropriate samplers and sampling procedures. In sand-bed streams, the sample is typically taken from the upper 5 centimeters of the bed surface. In gravel-bed streams with coarse surface layers, samples of both the surface and subsurface layers are required. Surface sampling of large particles can be done by hand using a pebble count method. However, a pebble count can be biased if there is a significant size fraction that is below 8 millimeters in size. For smaller particles, an adhesive surface sampling approach is often considered necessary.

Appendix D

GEI Bathymetry and River Elevation Requirements Memo

Memo

To:	Christopher Keipper - RG&E
From:	Richard Frappa, PG
Cc:	Kelly McIntosh, PE
Date:	4/4/2017
Re:	RG&E West Station MGP Pre-Design Investigation - Genesee River Sediments
	GEI Project No. 128480

The purpose of this memo is to provide RGE with general information concerning a desire to lower the surface water elevation of the Genesee River during river sediment investigation work to characterize river sediment near shore to the West Station Former MGP Site for remedial design.

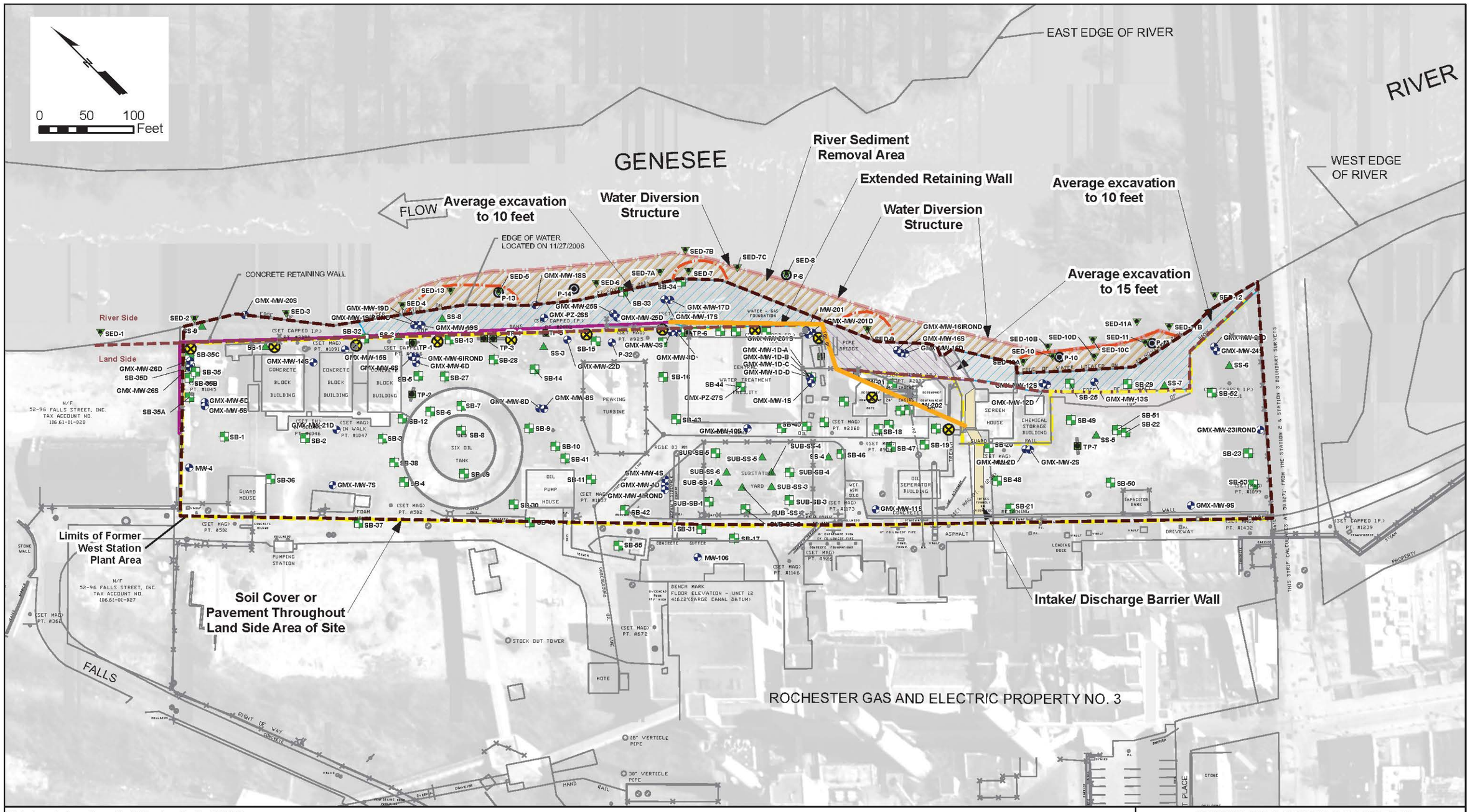
The recommended remedy for the Former West Station Manufactured Gas Plant Site described in the Remedial Action Work Plan (GEI, 2016) includes the removal of coal-tar impacted sediments from the Genesee River adjacent to the West Station Site. The remedial design for sediment removal will likely include use a surface water diversion structure. Figure 1 shows the area of sediment removal. Remedy design requires preparation of a Pre-Design Investigation (PDI) Work Plan and PDI implementation. The PDI will involve assessing the thickness of sediments adjacent to the site as well as characterizing the size of the sediment materials present in the River above the bedrock.

In 2009, GEI conducted an assessment of Genesee River sediments between the High Falls and the Middle Falls using boat-mounted vibratory core samplers. While useful information was obtained regarding the presence/absence of coal tar-related materials in the river, the swift river current and a river armor layer of cobbles and boulders present over softer, finer grained sediments made detailed characterization of river sediments problematic and often produced inclusive top of bedrock data.

Previous remedial investigations involving near shore sediment characterization were conducted when RGE's Hydro Group temporarily lowered the surface water elevation of the river. The lower surface water elevation allowed sampling crews to access the near-shore river environment and complete probing and sediment sample collection using hand tools and a mini-excavator.

Figure 2 superimposes GEI 2009 river bathymetry information (surface elevation of river armor layer sediment) over the area requiring sediment removal. As shown on Figure 2, GEI anticipates working in an area adjacent to the Site from the south at an elevation of 390 (+/-) Feet Mean Sea Level (fasl) to an elevation to the north of 386 (+/-) fasl within sediment removal area. Lowering the surface water elevation of the river to elevations 1 to 2 feet below to these elevations would facilitate the collection of higher quality river sediment characterization data to support the design for sediment removal.

At this time, it is anticipated that river sediment characterization would require two concurrent crews consisting of three to four working personnel using a mini-excavator and/or a track-mounted Geoprobe equipped with augers and coring tools. The ideal work hours when the river level would be required to remain low would be from approximately 7am and 4pm, daily during a 3 to 4 day period.



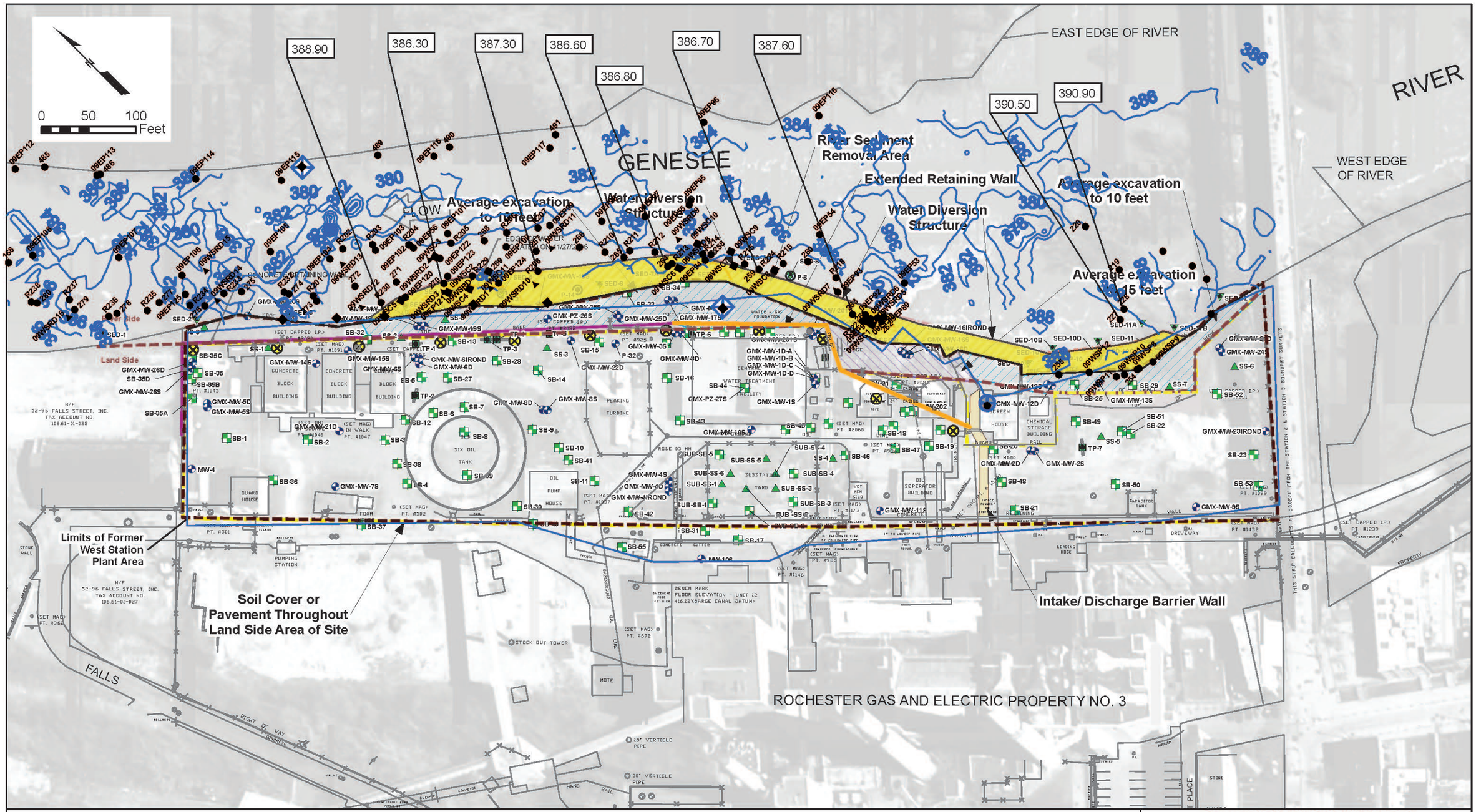
Original map by Amec-Geomatrix, 2010 and modified by GEI 2016.

Explanation

- Monitoring Well
- Pore Water
- Sediment Sample
- Soil Boring
- Surface Soil
- Test Pit
- Passive DNAPL recovery well
- Extension of existing barrier wall
- Extent of sediment impacts (RI)
- River sediment removal area
- Average excavation to 10 feet
- Average excavation to 15 feet
- Intake/ Discharge Barrier Wall
- Extent of Cover System (1-2 ft soil or pavement)

RECOMMENDED REMEDY-ALTERNATIVE 3:
EXTEND EXISTING BARRIER WALL,
DNAPL RECOVERY, SOIL COVER
Rochester Gas and Electric
West Station Former MGP Plant Area
Remedial Action Work Plan
Rochester, New York

By: MC	Date: 10/2016	Project No. 128480
GEI Consultants	Figure	1



Original map by Amec-Geomatrix, 2010 and modified by GEI 2016.

Explanation

- Monitoring Well
- Pore Water
- Sediment Sample
- Soil Boring
- Surface Soil
- Test Pit
- Passive DNAPL recovery well
- Extension of existing barrier wall
- Extent of sediment impacts (RI)
- River sediment removal area
- Average excavation to 10 feet
- Average excavation to 15 feet
- Intake/ Discharge Barrier Wall
- Extent of Cover System (1-2 ft soil or pavement)
- 388.90 Elevation of River Bottom (fasl)

RECOMMENDED REMEDY-ALTERNATIVE 3:
EXTEND EXISTING BARRIER WALL,
DNAPL RECOVERY, SOIL COVER
Rochester Gas and Electric
West Station Former MGP Plant Area
Remedial Action Work Plan
Rochester, New York

By: MC	Date: 3/2017	Project No. 128480
GEI Consultants		Figure 2

Appendix E

Former River Water Intake/Beebee Station Discharge Tunnel Drawing

PLAN

SECTION A-A

NOTICE REVISIONS—RETURN TO DRAFTING DEPARTMENT ALL PRINTS PRIOR TO LAST REVISION

E		C		A	
DATE	O. K'd BY	DATE	O. K'd BY	DATE	O. K'd BY
F		D		B	
DATE	O. K'd BY	DATE	O. K'd BY	DATE	O. K'd BY

REFERENCE DRAWINGS

General Arrangement of Tunnels	30276 1/2	Rock Elev. Foundations Coke Ovens	31401-3
Cold & Hot Well for Turbine No. 3	30290	General Layout of Coke Ovens	
" " " " No 1 & 2	30330 1/2	Details of New Pump House	
Details of Intake	30296	Sectional Elev. Coke Ovens	3-375
Foundations Tunnel of Turb No. 3	30287		
Hoist & Flood Walls of Gate House	31245		
Tbl Plan Eng. Room Am. Bridge Co.	E-3		

DRAWN BY A.J. Brady 10-21-33
TRACED L.E. Bergen 11-2-33
CHECKED
ENGR
SAFETY ENGR
DEPT. SUPT.
DEPT. SUPT. ASST.
CHIEF ENGR

ROCHESTER GAS & ELECTRIC CORP.
ROCHESTER, NEW YORK
DEPT.
FOLDER NO.
SCALE INCH=1 FT. 10 FT PER IN.
JOB NO. No. 31293

STATION No 3 - STEAM PLANT EQUIPMENT
CONDENSING WATER TUNNELS FOR TURBINES
INTAKE, HOT & COLD WELLS
LAYOUT

Reference Line - Zero Azimuth
All ℄s turned from this line.
This line is parallel to ℄ of parapet.

℄ - Steam Bridge
See Dwg. 31121.

GENESEE RIVER

412.30

Note :- This traverse station is connected by a traverse, running from N.W. Cor. of parapet wall of concrete culvert, Opposite E. door of Main Turbine Bldg., Station 3.
For a complete description & notes of this survey - See transit book - No. 90639. For detailed location of Main Turbine Bldg., see Dwgs. :-

412.46

℄ - Tar & Oil Gas Tanks
West Station Water Gas Plant. See Dwgs :- 31185-20 ; 31185-68.

409.64
409.8 ±
409.5 ±
409.6 ±
407.73

Condenser Water Discharge

Weir Crest.

Derrick relocated on bank

Condenser Water Intake.

Face of wall

390.65
390.60
392.05

Soundings 7-18-24
BR 90639 pg 12
See Dwg 31121

See 31236-1

NOTICE REVISIONS — RETURN TO DRAFTING DEPARTMENT ALL PRINTS PRIOR TO LAST REVISION

(E)		(C)		(A)	
DATE	O. K'D. BY	DATE	O. K'D. BY	DATE	O. K'D. BY
(F)		(D)		(B)	
DATE	O. K'D. BY	DATE	O. K'D. BY	DATE	O. K'D. BY

REFERENCE DRAWINGS

Survey Notes.	90639
Similar Survey	31121
Gas & Oil Tanks	31185-20
" " " "	31185-68

DESIGN ACCT. CONST'N ACCT.
DRAWN 7-24-24
TRACED
CHECKED
ENG.
CO-OPER.
ENG. in CH'G
DEPT. SUP'T.
GEN. MGR.

ROCHESTER GAS & ELECTRIC CORP.
ROCHESTER, NEW YORK

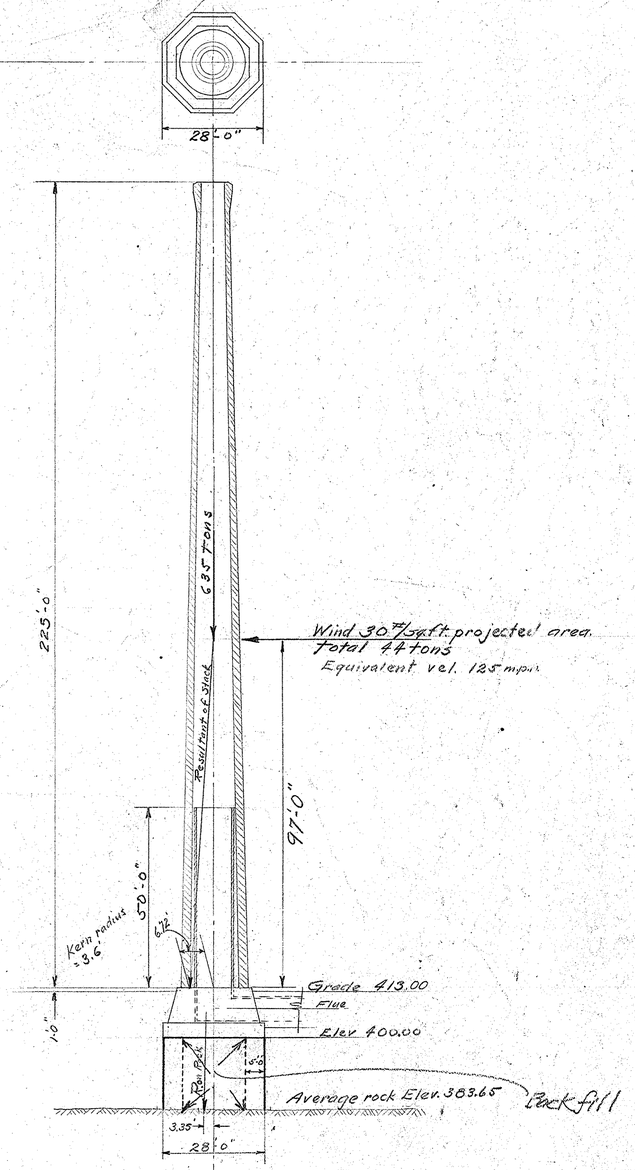
THIS COPY SENT TO

SCALE INCH = 1 FT. 10 FT. PER IN. 1.

THIS DRAWING SUPERSEDED BY NO. | THIS DRAWING SUPERSEDES NO.

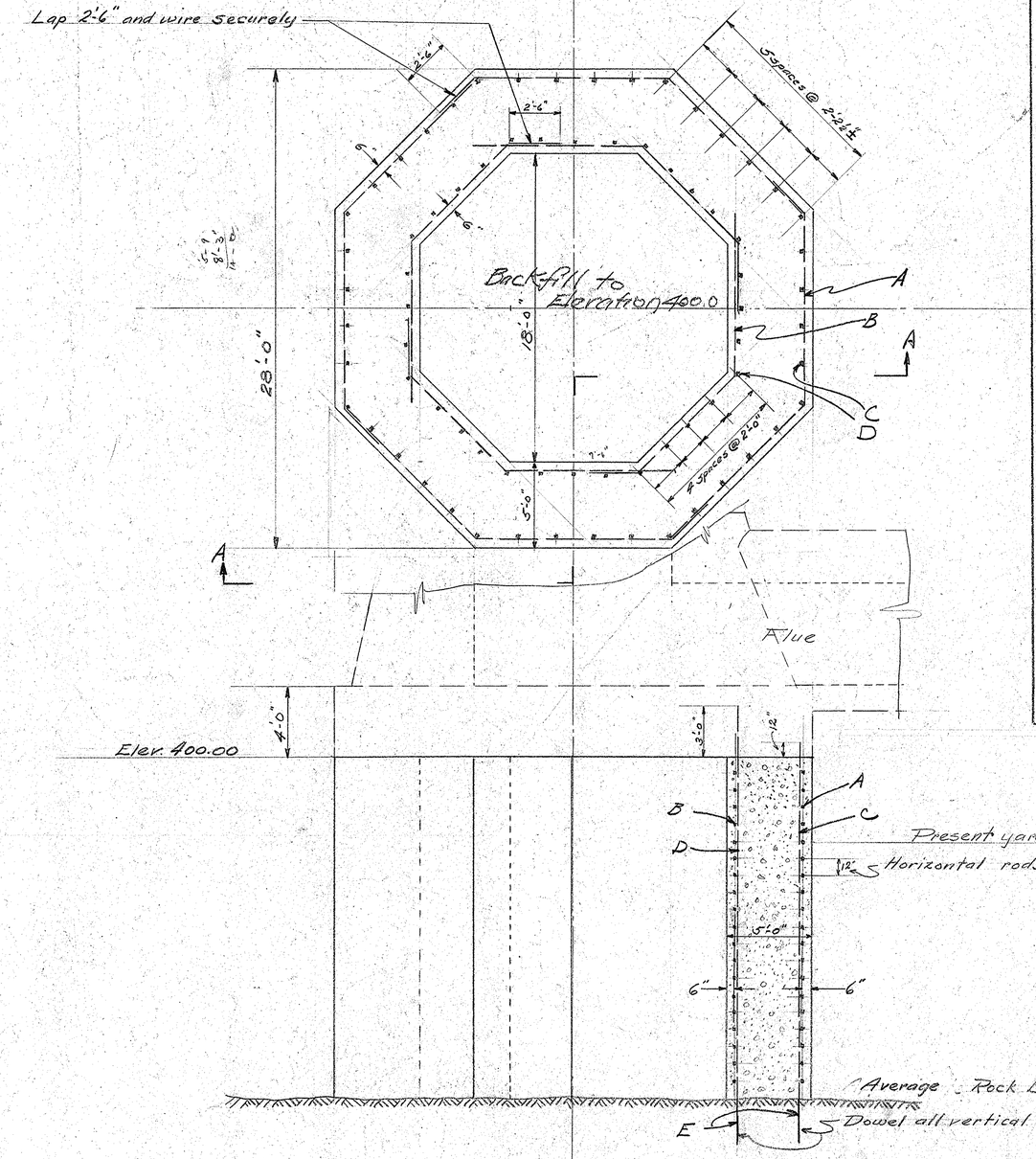
STATION 3-CONDENSER TUNNEL TOPOGRAPHY NORTH OF DISCHARGE TUNNEL

NUMBER No. 31236. DATE PRINTED



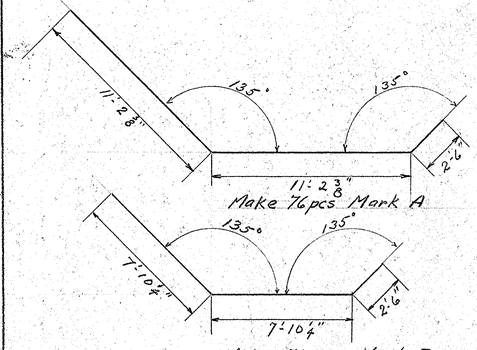
Max. load on rock 6.64 tons per sq. ft
Max shear in base 14# ± per sq in

Scale - 1/20 = 1 FT.



Section A-A

Note:
Steel to be 1" square deformed bars bent and placed as shown and securely wired in place.
Concrete to be 1:3:3 mix of washed sand and gravel. All dowels to be grouted before main pour is started.
Excavate to good rock, and make bottom of cut level.



Reinforcing Schedule.

NOTICE REVISIONS—RETURN TO DRAFTING DEPARTMENT ALL PRINTS PRIOR TO LAST REVISION.

E	C	A
DATE / O. K'd BY	DATE / O. K'd BY	DATE / O. K'd BY
F	D	B
DATE / O. K'd BY	DATE / O. K'd BY	DATE / O. K'd BY

REFERENCE DRAWINGS

DRAWN: Rivers 6/5/28
TRACED:
CHECKED: Brown 6/6/28
CHIEF ENGR.
ASST. ENGR.
SUPT.
CHIEF ELEC. ENGR.
CHIEF O. ENGR.

ROCHESTER GAS & ELECTRIC CORP.
ROCHESTER, NEW YORK
DEPT.
FOLDER NO.
SCALE 1/4 INCH=1 FT. FT. PER IN.

West Station Gas Works
Sub Foundation for Stack
Coke Oven Battery #3

JOB NO. NO. 3/758-1

Appendix F

Historic Utility Summary

GENESEE RIVER

SHORELINE (APRIL 13, 1989)

Pipe Bridge to East Station

48" dia.
Water Gas Line

CONCRETE RETAINING WALL

CONCRETE RETAINING WALL

Electrical Subway Duct

4" Line (Auto Sprinklers)

20" Retort Gas Line

Former
Compressor
House

BLDG. 16

BLDG. 17

BLDG. 18

Cooling Water Lines

20" Oven Gas Line

Gravity Water Line
to Former Retort

15" V.T. Sewer

6" Holley (water) line

12" V.T. Sewer

GUARD
HOUSE

FOAM
HOUSE

Former
1.3 Million Gallon
Fuel Oil Tank
with Secondary
Containment

OIL
PUMP
HOUSE

GAS TURBINE

#2 Fuel Oil
Transmission Line

Schedule 80 PVC Forcemain

City of Rochester
Garbage Incinerator
(closed)

2" Water Service

CONCRETE
BLOCK
BUILDING

BRICK
BLDG.

Schedule 80 PVC Forcemain

UNIT NO. 12

Fuel Oil
Storage
Tanks

-Site basemap based on Atlantic Environmental Serivces drawing entitled "Soil Gas Locations" dated 1991, and modifed by Stephen M. Bly, P.L.S., December, 2006

EXPLANATION

- Manhole/ Vault
- Water Line (buried)
- Gas Line
- Electrical Line
- Sewer/ Tile
- No. 2 Fuel Oil Line

N

0 80 160
Feet

UNDERGROUND UTILITIES & CURRENT STRUCTURES- North Plant Area
RG&E West Station
Rochester, New York

MC	Date1/24/2008	Project No. 12661.000
Geomatrix		Appendix **F**

File path: S:\12600\12661\12661.000\task_01\07_1120_rge15_fig_02.mxd

GENESEE RIVER

CENTRAL
WATER TREATMENT
FACILITY

OIL STORAGE
TANKS

SCREEN
HOUSE

CHEMICAL
STORAGE
BUILDING

Discharge Tunnel

12' Diameter Intake/

TRANSFORMER
YARD

OIL
SEPARATOR
BLDG.

CAPACITOR BANKS

RELAY HOUSE

UNIT NO. 12

STORAGE TANKS

BEBEE STATION

-Site basemap based on Atlantic Environmental Serivces drawing entitled "Soil Gas Locations" dated 1991, and modifed by Stephen M. Bly, P.L.S., December, 2006

EXPLANATION

- Manhole/ Vault
- Water Line (buried)
- Gas Line
- Electrical Line
- Sewer/ Tile
- No. 2 Fuel Oil Line

0 80 160
Feet

UNDERGROUND UTILITIES &
CURRENT STRUCTURES- South Plant Area
RG&E West Station
Rochester, New York

MC	Date1/24/2008	Project No. 12661.000
Geomatrix		Appendix **F**

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Appendix G

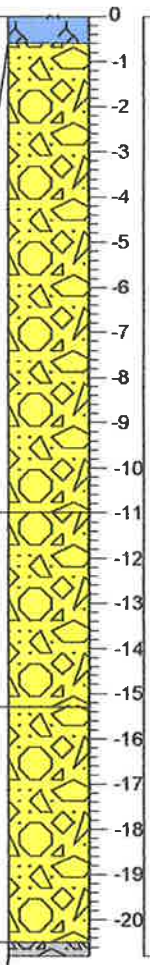
Historic Boring Logs (prior to RI)

WS-SB01

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/5/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Harry Lyon
DRILLING METHOD: Direct Push

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: 414.496 ft. above MSL
WELL ELEVATION: NA
OUTER CASING ELEV.: NA
DEPTH TO WATER:NA
BOREHOLE DEPTH: 20.8 ft. below grade
WEATHER: Cool, overcast, breezy
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-4	75	0.0		TOPSOIL: Moist, brown, fine sand and silt with some red clay and root material		
-1			0.0				
-2			0.0				
-3			0.0		FILL: Dry to moist, black to gray fill with silt, sand, gravel, coal-like material (CLM), brick pieces, and other debris		
-4	4-8	80	0.0				
-5			0.0				
-6			0.0				
-7			0.0				
-8	8-12	25	0.0				
-9			0.0				
-10			0.0				
-11			0.0				
-12	12-16	40	0.0		FILL: Dry to moist, black to gray fill with silt, sand, gravel, coal-like material (CLM), brick pieces, and other debris		
-13			0.0				
-14			0.0				
-15			0.0				
-16	16-20	50	0.0		FILL: Moist, brown to red, loose, medium sand and gravel with CLM and trace clay		
-17			0.0				
-18			0.0				
-19			0.0	19-20			
-20	20-20.8	20			WEATHERED BEDROCK: Moist, light gray, compact fine to medium sand and silt with broken fragments of weathered shale. Refusal on bedrock at 20.8'.		



PID (ppm) = Photoionization Detector, readings in ppm

WS-SB02

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/5/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Harry Lyon
DRILLING METHOD: Direct Push

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: Not Surveyed
WELL ELEVATION: NA
OUTER CASING ELEV.:NA
DEPTH TO WATER:NA
BOREHOLE DEPTH: 27.5 ft. below grade
WEATHER: Cold, snow flurries, overcast
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-4	75	0.0		TOPSOIL: Moist, compact, brown, fine sand with silt, clay and gravel		
-1			1				
-2			3		FILL: Dry to moist, loose, brown, medium sand with clay, silt and gravel		
-3			5				
-4	4-8	90	10		FILL: Moist, semi-compact, black, fine sand with clay and silt, some gravel and sheens with a tar-like odor present		
-5			21				
-6			51		FILL: Moist, sticky, compact, black, fine sand with some gravel and silt, NAPL and a tar-like odor present throughout interval		
-7			54				
-8	8-12	70	9		FILL: Moist, semi-compact, brown, fine to medium sand and gravel with shale fragments, and NAPL		
-9			0.5				
-10			4		FILL: Moist, compact, brown, fine sand with silt, clay, shale fragments and some weathered brick, slag-like material throughout		
-11			5				
-12	12-16	35	2				
-13			10				
-14			0.0		FILL: Same as the above unit with a very slight, tar-like odor and NAPL between 14 and 15.5'		
-15			4				
-16							

PID (ppm) = Photoionization Detector, readings in ppm

WS-SB02

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/5/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Harry Lyon
DRILLING METHOD: Direct Push

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: Not Surveyed
WELL ELEVATION: NA
OUTER CASING ELEV.: NA
DEPTH TO WATER:NA
BOREHOLE DEPTH: 27.5 ft. below grade
WEATHER: Cold, snow flurries, overcast
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-16	16-20	70	2		FILL: Moist, compact, brown, medium to fine sand with silt, trace clay, gravel, coal-like material (CLM), shale fragments and weathered brick		
-17			5				
-18			9				
-19			14				
-20	20-24	90	15				
-21			5				
-22			11				
-23			9		FILL: Moist, semi-compact, black, fine to coarse sand with black, viscous, sticky, tar-like material throughout interval		
-24	24-27.2	75	12				
-25			16	25-26	FILL: Wet, loose, black, fine to coarse sand with clay, gravel and shale fragments, tar-like odor and NAPL present throughout interval		
-26			17				
-27					FILL: Wet, loose, black, fine to medium sand with some gravel and NAPL present throughout. Refusal at 27.2' - likely on bedrock.		

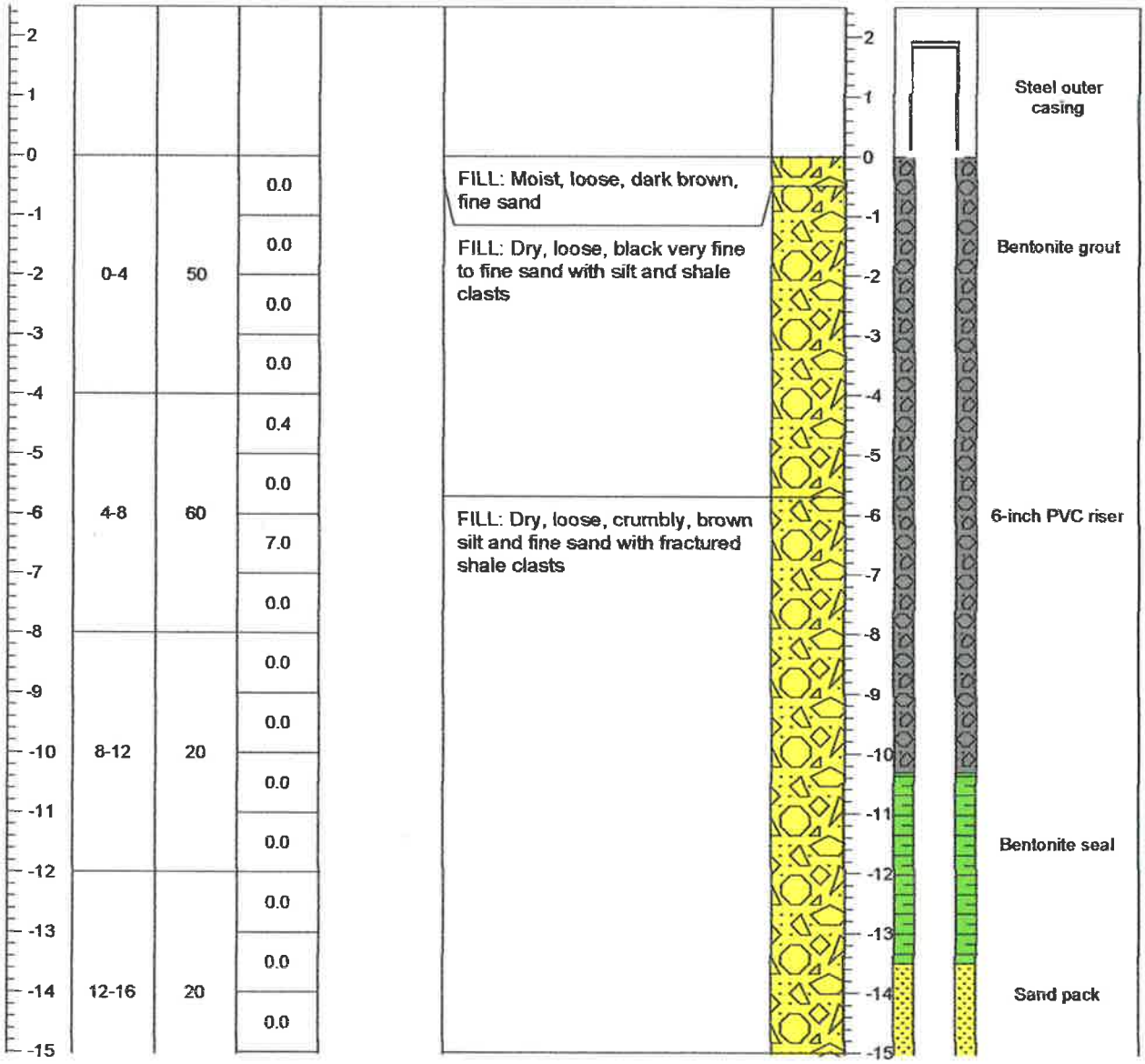
PID (ppm) = Photoionization Detector, readings in ppm

WS-SB03/RW01

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/6/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Craig Brown
DRILLING METHOD: Direct Push/Recovery Well Drilled w/10" HSAs

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: Not Surveyed
WELL ELEVATION: Not Surveyed
OUTER CASING ELEV.:415.89 ft. above MSL
DEPTH TO WATER:average=22.82 ft below grade
BOREHOLE DEPTH: 27.5 ft. below grade
WEATHER: Cloudy, cool, light breeze
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-4	50	0.0		FILL: Moist, loose, dark brown, fine sand		
-1			0.0				
-2			0.0		FILL: Dry, loose, black very fine to fine sand with silt and shale clasts		Bentonite grout
-3			0.0				
-4	4-8	60	0.4				
-5			0.0				
-6			7.0		FILL: Dry, loose, crumbly, brown silt and fine sand with fractured shale clasts		6-inch PVC riser
-7			0.0				
-8	8-12	20	0.0				
-9			0.0				
-10			0.0				
-11			0.0				Bentonite seal
-12	12-16	20	0.0				
-13			0.0				
-14			0.0				Sand pack
-15							



PID (ppm) = Photoionization Detector, readings in ppm

WS-SB03/RW01

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/6/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Craig Brown
DRILLING METHOD: Direct Push/Recovery Well Drilled w/10" HSAs

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: Not Surveyed
WELL ELEVATION: Not Surveyed
OUTER CASING ELEV.:415.89 ft. above MSL
DEPTH TO WATER:average=22.82 ft below grade
BOREHOLE DEPTH: 27.5 ft. below grade
WEATHER: Cloudy, cool, light breeze
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-15			2.6		FILL: Moist, compact, brown, fine sand and clay with fractured shale clasts, coal-like material (CLM) and slag-like material		
-16	16-20	20	3				
-17			0.0				
-18			0.0				
-19			1.2		FILL: Moist, compact, brown, fine sand and clay with fractured shale clasts		0.020-inch slotted screen
-20	20-24	55	12				
-21			85				Sand pack
-22			53		FILL: Moist, loose, gray shale fragments and gray clay with NAPL and sheens		Water level (7/25/06)
-23			113	22.5-23.5	FILL: Shale clasts with fine, black sand and black, sticky, tar-like material with a tar-like odor		Water level (5/24/06) Water level (4/28/06)
-24	24-27.5	90	87		FILL: Moist, loose, tan, gravel with fine sand and clay		
-25			65				
-26			16		FILL: Wet, loose, black, medium to coarse sand, gravel, trace clay and brick with NAPL, CLM, sheens and a mix of tar-like and fuel-like odors		
-27			13				
-28					FILL: Moist, compact, very fine sand with trace clay and a slight tar-like odor. Direct push refusal at 27.5'		
-29							2-feet x 6-inch PVC sump
-30							

PID (ppm) = Photoionization Detector, readings in ppm

WS-SB04

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/24/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:414.663 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 22 ft. below grade
WEATHER: Cool, light breeze, drizzling rain, overcast
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0								
-1	0-2	11,17,15	75	0.0		ASPHALT: Auger through asphalt		H-Weight of Hammer
-2				0.0		FILL: Dry to damp, light brown and gray, fine sand with clay, some shale clasts, weathered brick, gravel and coal-like material (CLM)		
-3	2-4	8,15,8,8	75	0.0				
-4				0.0				
-5	4-6	5,6,5,7	45	0.0				
-6				0.0				
-7	6-8	6,13,6,7	50	0.0	6.7-7			
-8				0.0				
-9	8-10	5,3,5,8	45	0.0				
-10				0.0				
-11	10-12	5,4,3,9	40	0.0		FILL: Dry, loose, light gray, medium to coarse sand with angular clasts of shale		
-12				0.0				
-13	12-14	4,2,2,3	50	0.0		FILL: Dry to damp, loose, black, medium to fine sand with slag-like material, trace fine tan sand with natural iron staining		
-14				0.0				
-15	14-16	2,2,2,5	50	0.0		FILL: Moist, compact, light brown, medium sand, clay and shale clasts with some (CLM)		
-16				0.0				
-17	16-18	H,H,H,3	60	0.0		FILL: Moist, compact, light gray, *medium to fine sand with clay and* sub-rounded gravel		
-18				0.0				
-19	18-20	H,3,5,12	40	0.0				
-20				0.0				
-21	20-22	14,32,20,50	60	0.0		WEATHERED BEDROCK: Damp to dry, very hard, compact, light brown clay with shale clasts throughout, weathered bedrock in shoe. Refusal on bedrock at 22.0'		
-22				0.0	21.5-22			

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB05/MW201

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/5/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Harry Lyon
DRILLING METHOD: Direct Push/ Well Drilled with 4 1/4" HSAs

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: Not Surveyed
WELL ELEVATION: Not Surveyed
OUTER CASING ELEV.: 416.15 ft. above MSL
DEPTH TO WATER:average=23.25 ft below grade
BOREHOLE DEPTH: 28 ft. below grade
WEATHER: Cool, overcast, breezy
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-4	50	0.0		TOPSOIL: Moist, loose brown, medium to fine sand with gravel		Steel outer casing
1			0.0				
2			0.0				
3			0.0		FILL: Dry to moist, loose, gray silt, clay and medium to fine *sand with broken shale* fragments, coal-like material (CLM), and weathered brick		
4	4-8	30	0.0				Bentonite grout
5			0.0				
6			0.0				
7			0.0				
8	8-12	80	0.0		FILL: CLM and slag-like material		2-inch PVC riser
9			0.0		FILL: Dry, loose, gray shale fragments with silt, trace clay and medium to fine sand		
10			0.0				
11			0.0		FILL: CLM and slag-like material		
12			0.0		FILL: Weathered brick		
13	12-16	30	0.0		FILL: CLM and slag-like material, very slight tar-like odor present		
14			0.0				Bentonite seal
15							

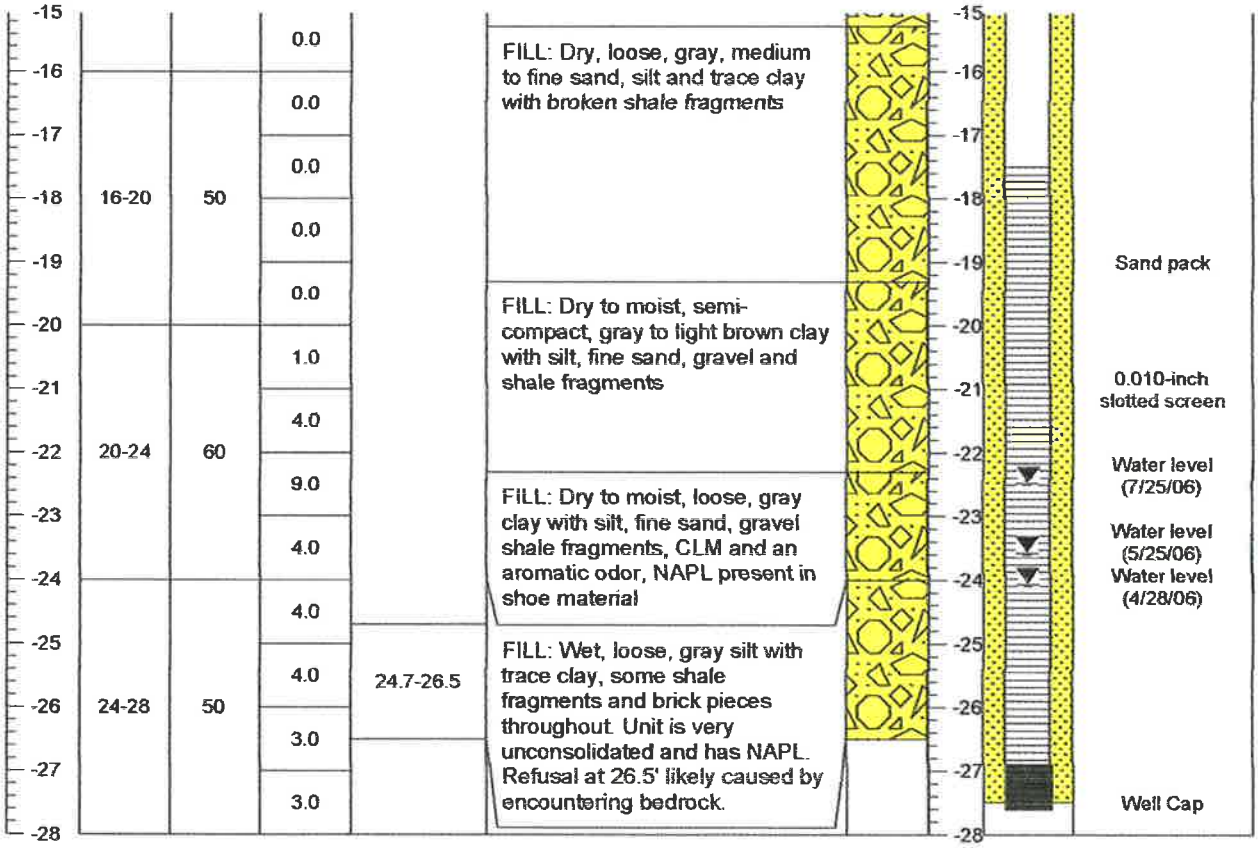
PID (ppm) = Photoionization Detector, readings in ppm

WS-SB05/MW201

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/5/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Harry Lyon
DRILLING METHOD: Direct Push/ Well Drilled with 4 1/4" HSAs

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: Not Surveyed
WELL ELEVATION: Not Surveyed
OUTER CASING ELEV.:416.15 ft. above MSL
DEPTH TO WATER:average=23.25 ft below grade
BOREHOLE DEPTH: 28 ft. below grade
WEATHER: Cool, overcast, breezy
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-15			0.0		FILL: Dry, loose, gray, medium to fine sand, silt and trace clay with broken shale fragments		
-16			0.0				
-17			0.0				
-18	16-20	50	0.0				
-19			0.0				Sand pack
-20			1.0		FILL: Dry to moist, semi-compact, gray to light brown clay with silt, fine sand, gravel and shale fragments		
-21			4.0				0.010-inch slotted screen
-22	20-24	60	9.0				Water level (7/25/06)
-23			4.0		FILL: Dry to moist, loose, gray clay with silt, fine sand, gravel shale fragments, CLM and an aromatic odor, NAPL present in shoe material		Water level (5/25/06)
-24			4.0				Water level (4/28/06)
-25			4.0	24.7-26.5	FILL: Wet, loose, gray silt with trace clay, some shale fragments and brick pieces throughout. Unit is very unconsolidated and has NAPL. Refusal at 26.5' likely caused by encountering bedrock.		
-26	24-28	50	3.0				
-27			3.0				Well Cap
-28							



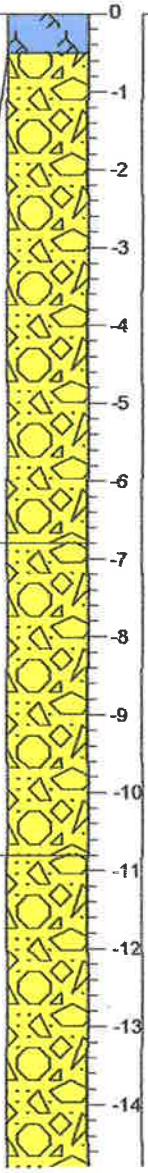
PID (ppm) = Photoionization Detector, readings in ppm

WS-SB06

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/6/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Craig Brown
DRILLING METHOD: Direct Push

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: 413.895 ft. above MSL
WELL ELEVATION: NA
OUTER CASING ELEV.:NA
DEPTH TO WATER:NA
BOREHOLE DEPTH: 28 ft. below grade
WEATHER: Sunny, cool, light breeze
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-4	60	0.0		TOPSOIL: Moist, loose, fine to coarse, brown sand with trace clay, sub-rounded gravel and root material		
-1			0.0				
-2			0.4		FILL: Moist, loose, fine to coarse, brown sand with trace clay, sub-rounded gravel and coal-like material (CLM)		
-3			0.2				
-4	4-8	50	0.0				
-5			0.0				
-6			0.0				
-7			0.0		FILL: Moist, loose brown, medium to coarse sand with large angular rock clasts, fine gravel, and hard, cement-like aggregate between 7.35 and 8 ft bgs		
-8	8-12	40	0.0				
-9			0.0				
-10			0.0				
-11			0.0		FILL: Moist, loose, brown and black clay with medium to coarse sand, CLM, weathered brick, shale fragments and gravel		
-12	12-16	30	0.0				
-13			0.0				
-14			0.0				



PID (ppm) = Photoionization Detector, readings in ppm

WS-SB06

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/6/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Craig Brown
DRILLING METHOD: Direct Push

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: 413.895 ft. above MSL
WELL ELEVATION: NA
OUTER CASING ELEV.: NA
DEPTH TO WATER:NA
BOREHOLE DEPTH: 28 ft. below grade
WEATHER: Sunny, cool, light breeze
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-15			0.0		FILL: Moist, loose, brown and black clay with medium to coarse sand, CLM, weathered brick, shale fragments and gravel		
-16	16-20	25	0.0				
-17			0.1				
-18			0.2				
-19			0.2				
-20	20-24	60	19		FILL: Moist, loose, light brown and white clay with some silt, medium to coarse sand and large shale clasts		
-21			22				
-22			28		FILL: Wet, loose, brown and gray clay with medium to coarse sand, CLM, weathered brick, *shale fragments and gravel*, *fuel*-like odor present		
-23			20				
-24	24-25.6	90	163				
-25			52	24.6-25.6			
-26	25.6-28	50	0.0		WEATHERED BEDROCK: Wet, loose, gray, weathered shale with trace clay and trace medium to coarse sand, boring terminated in bedrock at 28.0'		
-27			0.0				
-28							

PID (ppm) = Photoionization Detector, readings in ppm

WS-SB07

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/6/2006
DRILLING CONTRACTOR: Lyon Drilling
DRILLER: Craig Brown
DRILLING METHOD: Direct Push

SAMPLING METHOD:4' Geoprobe Macro-cores
GROUND ELEVATION: 413.777 ft. above MSL
WELL ELEVATION: NA
OUTER CASING ELEV.:NA
DEPTH TO WATER:NA
BOREHOLE DEPTH: 20.7 ft. below grade
WEATHER: Cool, light breeze, cloudy
GEOLOGIST: Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-4	60	0.0		FILL: Dry to moist, loose, brown, medium to coarse sand with clay, sub-rounded gravel, shale fragments and weathered brick		
-1			0.0				
-2			0.0				
-3			0.0				
-4	4-8	70	0.4				
-5			04				
-6			02				
-7			02				
-8	8-12	95	0.0		FILL: Dry to damp, hard, tight, brown, medium to coarse sand with sub-rounded gravel, shale clasts and weathered brick		
-9			0.0				
-10			0.0				
-11			0.0				
-12	12-16	90	0.0				
-13			0.0				
-14			0.0				
-15			0.0		FILL: Dry to damp, brittle, loose, black, coal-like material (CLM), with slag-like material, and a slight fuel-like odor		
-16	16-20	40	1.5				
-17			8.5				
-18			2.5				
-19			2		FILL: Moist, brittle, black CLM *and slag-like material with brown* clay and fine to medium sand and gravel, with a fuel-like odor. Direct push refusal at 20.7'		
-20	20-20.7	95	1	20-20.7			

PID (ppm) = Photoionization Detector, readings in ppm

WS-SB07A

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/27/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoon
GROUND ELEVATION:413.967 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 28 ft. below grade
WEATHER: Warm, breezy, clear sky
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-20						SB07A is a continuation of SB07 which hit refusal before bedorck was reached. The location of SB07A is about 15 feet west of SB07. Augers were advanced to 21' below ground surface where sampling began.		
-21	20-22	5,4,4,6	40	300				
				300		FILL: Moist to wet, loose, gray clay with fine to medium sand, shale clasts and a very slight fuel-like odor		
-22								
				300				
-23	22-24	4,10,9,10	35					
				571	23-24	FILL: Wet, *loose, black stained clay* with coal-like material, green-tinted sheen a few NAPL globules between 23.3 and 23.6, fuel-like odor present		
-24								
				0.0		FILL: Wet, cohesive, gray clay with medium sand, weathered brick and shale clasts		
-25	24-26	Not recorded	20					
				0.0				
-26								
-27	26-28	Not recorded	>5					
						WEATHERED BEDROCK: Wet, gray clay and shale clasts. Boring terminated in bedrock at 28.0'		
-28								

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB08

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/25/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:415.086 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 28.2 ft. below grade
WEATHER: Cool, light breeze, overcast
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0								
-1	0-2	1,1,2,3	75	0.0		TOPSOIL: Damp, loose, brown, fine sand with rounded gravel and root material		H-Weight of Hammer
-2				0.0				
-3	2-4	3,3,3,4	70	0.0		FILL: Dry, loose, black, coal-like material (CLM), clinker-like material, and ash-like material (ALM)		
-4				0.0		FILL: Damp, cohesive, brown clay with fine to coarse sand and gravel		
-5	4-6	2,2,2,4	40	0.0		FILL: Dry to damp, loose, black, fine sand with trace brown clay and CLM, ALM, weathered brick and slag-like material		
-6				0.0				
-7	6-8	2,3,2,1	25	0.0				
-8				0.0				
-9	8-10	1,1,H,H	50	0.0				
-10				0.0				
-11	10-12	1,1,H,1	70	0.0				
-12				0.0				
-13	12-14	1,2,2,2	25	0.0				
-14				0.0		FILL: Dry to moist, loose, gray and brown, medium to coarse sand with *clay, gravel, shale clasts, weathered* brick and CLM		
-15	14-16	1,4,14,7	50	0.0				
-16				0.0				

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB08

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/25/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:415.086 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 28.2 ft. below grade
WEATHER: Cool, light breeze, overcast
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-16								H-Weight of Hammer
-17	16-18	5,3,7,14	70	874		FILL: Moist, cohesive, clay with fine, yellow and brown sand, small angular gravel, CLM and shale clasts		
-18				275				
-19	18-20	4,3,4,8	60	383		FILL: Moist, loose, black, fine sand with a fuel-like odor		
-20				425				
-21	20-22	5,9,10,7	65	7654	20-21.6	FILL: *Wet to moist, loose, black,* coarse sand and shale clasts with NAPL present, sheens and a tar-fuel-oil mix odor		
-22				913		FILL: Moist, gray clay with silt with tar-like material (TLM) that is very viscous, sticky, and black with sheens		
-23	22-24	12,15,18,8	80	615		FILL: Wet, black, silty material with coarse sand and shale clasts with NAPL, sheens and tar-like odor		
-24				455				
-25	24-26	5,5,2,9	70	913		FILL: Dry, brown, fine sand with shale clasts, slight tar-like odor		
-26				2001		FILL: Dry to moist, brown silt with black, sticky, viscous, TLM, some shale clasts and a tar-like odor		
-27	26-28	9,12,10,10	30	325	26-27.2	WEATHERED BEDROCK: Wet, fine, loose, black, sand with shale clasts, NAPL and sheens. Refusal on bedrock at 28.2'		
-28				175				
-29	28-30	10, 50 for 2"	10	175				
-30				170				

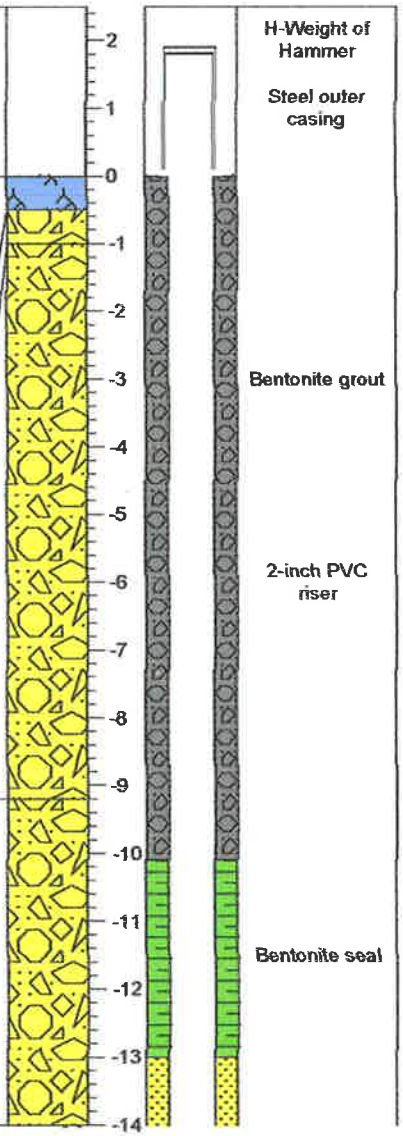
PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB09/MW202

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/26/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:Not Surveyed
WELL ELEVATION:Not Surveyed
OUTER CASING ELEVATION:417.821 ft. above MSL
DEPTH TO WATER: average=24 ft. below top of casing
BOREHOLE DEPTH: 25 ft. below grade
WEATHER: Warm, sunny, breezy
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL
2						
1						
0						
-1	0-2	4,6,8,6	70	0.0		TOPSOIL: Dry to damp, loose, gray, fine to medium sand with gravel, root material and trace clay
				0.0		
-2						FILL: Damp, black, fine sand with fine gravel and natural iron staining
-3	2-4	7,6,7,5	5	0.0		FILL: Dry to damp, loose, brown, medium to coarse sand with sub-rounded, fine gravel, broken shale clasts, with trace clay, weathered *brick material and coal-like material* (CLM) at 7.5
				0.0		
-4						
-5	4-6	3,2,1,H	30	0.0		
				0.0		
-6						
-7	6-8	1,2,6,9	20	0.0		
				0.0		
-8						
-9	8-10	4,5,4,6	40	0.0		
				0.0		FILL: Moist to damp, cohesive, loose, brown, clay with fine sand, shale clasts and weathered brick
-10						
-11	10-12	2,3,7,4	30	0.0		
				0.0		
-12						
-13	12-14	2,4,4,11	35	0.0		
				0.0		
-14						



PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB09/MW202

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/26/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:Not Surveyed
WELL ELEVATION:Not Surveyed
OUTER CASING ELEVATION:417.821 ft. above MSL
DEPTH TO WATER: average=24 ft. below top of casing
BOREHOLE DEPTH: 25 ft. below grade
WEATHER: Warm, sunny, breezy
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-14								
-15	14-16	4,11,9,5	30	0.0		FILL: Moist to damp, cohesive, loose, brown, clay with fine sand, shale clasts and weathered brick		
				0.0				
-16								
-17	16-18	8,5,4,11	30	--				0.010-inch slotted screen
				--		FILL: Wet, loose, black, coarse sand with broken shale clasts and a moderate fuel-like odor		
-18								
-19	18-20	3,2,3,10	40	--				
				--		FILL: Wet, black, porous, medium to coarse sand with slag-like material, and a moderate fuel-like odor		Sand pack
-20								
-21	20-22	10,13,7,5	55	--				
				150	21-22	FILL: Wet to moist, gray clay with some yellow staining, with medium to coarse sand and shale clasts, moderate fuel-like odor		
-22								
-23	22-24	8,21,23,22	90	250				
				2556		FILL: Wet, black, porous, medium to coarse sand with slag-like material, and a moderate fuel-like odor		Water level (4/28 and 5/24/06)
-24								Water level (7/26/06)
-25	24-26	14, 50 for 3"	50	0.0		WEATHERED BEDROCK: Wet to moist, gray clay with angular shale clasts and a moderate fuel-like odor		
				0.0				1-foot x 2-inch PVC sump
-26						WEATHERED BEDROCK: Weathered shale with a fuel-like odor. Refusal on bedrock at 25.0'		

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB10

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/24/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:414.451 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 22.5 ft. below grade
WEATHER: Cool, light breeze, drizzling rain, overcast
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0								
-1	0-2	1,4,9,	30	0.0		ASPHALT: Auger through asphalt		
				0.0		FILL: Dry to damp, loose, black, fine sand and sub-rounded gravel with slag-like material and coal-like material (CLM)		
-2								
-3	2-4	12,13,14,11	60	0.0				
				0.0				
-4						FILL: Weathered brick, some CLM, shale clasts and ash-like material		
-5	4-6	4,4,3,2	50	0.0		FILL: Dry, compact, light brown, clay, silt, fine sand with shale fragments		
				0.0				
-6								
-7	6-8	2,2,3,2	21	0.0				
				0.0				
-8								
-9	8-10	2,2,3,2	15	0.0				
				0.0				
-10								
-11	10-12	2,7,6,6	20	0.0				
				0.0				
-12								

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB10

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/24/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:414.451 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 22.5 ft. below grade
WEATHER: Cool, light breeze, drizzling rain, overcast
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-12								
-13	12-14	2,7,4,2	45	0.0		FILL: Dry, compact, light brown, clay, silt, fine sand with shale fragments		
				0.0				
-14								
-15	14-16	3,5,8,5	45	0.0				
				0.0				
-16								
-17	16-18	2,14,31,15	75	0.0				
				0.0		FILL: Dry, loose, tan and yellow, medium to coarse, clumpy sand		
-18						FILL: Dry loose, black, brittle CLM with a tar-like odor, some slag-like material and weathered brick		
-19	18-20	6,9,8,10	75	0.0				
				0.0		FILL: Moist, loose, black, medium sand with CLM, ash-like material, and rock clasts with sheens from 20.5-20.9, tar-like odor present		
-20								
-21	20-22	4,12,30,15	70	--	20.6-20.8			
				--	21-22	WEATHERED BEDROCK: Damp to moist, cohesive, light brown and gray clay with medium to fine sand, with shale fragments with a fuel-like odor. Refusal on bedrock at 22.5'		
-22		6, 50 for 2"						

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB11

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/26/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:414.779 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 24 ft. below grade
WEATHER: Warm, sunny, breezy
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0								
-1	0-2	9,5,7,5	50	0.0		FILL: Dry, loose, brown, medium to coarse sand with gravel, rock clasts and trace clay		H-Weight of Hammer
-2				0.0				
-3	2-4	3,2,2,3	75	0.0		FILL: Dry, loose, black, fine sand with slag-like material, fine gravel, rock fragments, coal-like material (CLM) and trace clay		
-4				0.0				
-5	4-6	5,6,5,6	60	0.0		FILL: Moist, loose, light brown, medium to coarse sand with trace clay and rock fragments		
-6				0.0		FILL: Moist, loose, cohesive, brown, medium to fine sand with clay, shale clasts, natural iron staining and CLM		
-7	6-8	7,6,4,4	30	0.0		FILL: Dry, hard, loose, fine, brown sand and silt with shale clasts		
-8				0.0		FILL: Damp, cohesive, brown, clay *and silt, fine sand and shale clasts* with CLM and slag-like material		
-9	8-10	2,4,3,3	25	0.0				
-10				0.0				
-11	10-12	3,2,1,H	25	0.0				
-12				0.0				H-Weight of Hammer
-13	12-14	1,1,H,3	10	0.0				
-14				0.0				

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB11

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/26/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoons
GROUND ELEVATION:414.779 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 24 ft. below grade
WEATHER: Warm, sunny, breezy
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-14								
-15	14-16	4,2,2,2	10	0.0		FILL: Damp, cohesive, brown, clay and silt, fine sand and shale clasts with CLM and slag-like material		
				0.0				
-16								
-17	16-18	1,1,H,1	10	0.0		FILL: Moist, loose, brown clay, medium to coarse sand, fine gravel, shale clasts and weathered brick		
				0.0				
-18								
-19	18-20	2,2,1,H	10	0.0				
				0.0		FILL: Wet to moist, loose, brown, broken shale clasts with clay, silt and fine sand		
-20								
-21	20-22	1,1,H,1	<5	0.0		FILL: Dry, loose, tan, clumpy, coarse sand with ash-like material, and fine gravel		
				0.0				
-22								
-23	22-24	1,2,4, 50 for 3"	20	0.0		FILL: Wet, loose, brown, fine sand and silt with ash-like material and cinder-like material		
				50	23.5-24	WEATHERED BEDROCK: Moist, gray, compact silt, clay, fine sand and shale with a faint fuel-like odor. Refusal on bedrock at 24.0'		
-24								

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB12 A

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/27/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoon
GROUND ELEVATION:414.841 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 10 ft. below grade
WEATHER: Warm, cloudy, light breeze
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-2	7,11,12,9	90	0.0		FILL: Loose, dry to damp, gray silt, fine sand, clay and angular shale clasts and sub-angular gravel		
-1				0.0				
-2	2-4	9,6,4,4	80	0.0		FILL: Dry to damp, loose, porous, black, coal-like material (CLM) and cinder-like material with fine to medium brown sand and trace clay with a slight tar-like odor throughout interval		
-3				300				
-4	4-6	2,1,5,10	50	0.0				
-5				0.0				
-6	6-8	13,13,14,8	80	1,637				
-7				567				
-8	8-10	Not Recorded	72	8,657	8-10	FILL: Tight, cohesive, damp, gray clay with silt and large shale clasts		
-9				2,809		FILL: Damp, black, loose, fine sand with fine gravel with trace clay FILL: Broken, loose, dry shale clasts		
-10						FILL: Moist, cohesive, tan clay with black staining, CLM, with a fuel-oil and tar-like odor, broken shale clasts and concrete material in shoe. Refusal at 10' on large drainage pipe (02 discharge pipe)		

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB12 B

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/27/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoon
GROUND ELEVATION:415.014
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 8 ft. below grade
WEATHER: Warm, cloudy, light breeze
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-2	7,11,12,9	90	0.0		FILL: Loose, dry to damp, gray silt, fine sand, clay and angular shale clasts and sub-angular gravel		
-1				0.0				
-2	2-4	9,6,4,4	80	0.0		FILL: Dry to damp, loose, porous, black, coal-like material (CLM) and cinder-like material with fine to medium brown sand and trace clay with a slight tar-like odor		
-3				300				
-4	4-6	2,1,5,10	50	0.0				
-5				0.0				
-6	6-8	13,13,14,8	80	1,637				
-7				567		FILL: Tight, cohesive, damp, gray clay with silt and large shale clasts. Refusal at 8.0' below grade		
-8								

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB13

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/27/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Auger

SAMPLING METHOD:2' Split Spoon
GROUND ELEVATION:414.512 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 26.3 ft. below grade
WEATHER: Sunny, breezy, partly cloudy
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0								
-1	0-2	5,7,7,7	80	0.0		FILL: Loose, dry to damp, gray silt, fine sand, clay and angular shale clasts and sub-angular gravel		
-2				0.0				
-3	2-4	8,6,4,6	80	0.0		FILL: Dry to damp, loose, fine sand and porous, black, coal-like material (CLM)		
-4				0.0		FILL: Dry, cohesive, brown clay		
-5	4-6	10,9,7,7	45	0.0		FILL: Dry, loose, brown clay, medium sand, fine angular gravel, shale clasts, weathered brick, CLM and white ALM with some slag-like material		
-6				0.0				
-7	6-8	5,5,3,2	30	0.0		FILL: Damp, black, medium sand and shale clasts		
-8				0.0		FILL: Dry, hard, brown, clay, silt and fine to medium sand with fine, angular gravel and broken shale		
-9	8-10	5,2,2,3	30	0.0		FILL: Moist, loose, brown, clay and silt, fine to coarse sand with broken shale clasts, weathered brick and CLM		
-10				0.0				
-11	10-12	3,2,3,2	30	0.0				
-12				0.0		FILL: Moist, loose, brown, clay and silt, fine to coarse sand with broken shale clasts, weathered brick and CLM		
-13	12-14	2,3,10,4	25	0.0				
-14				0.0				
-15	14-16	4,3,4,2	30	0.0				
-16				0.0				

PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB13

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/27/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Auger

SAMPLING METHOD:2' Split Spoon
GROUND ELEVATION:414.512 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION.NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 26.3 ft. below grade
WEATHER: Sunny, breezy, partly cloudy
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-16								
-17	16-18	2,6,1,4	25	0.0		FILL: Moist, loose, brown, clay and silt, fine to coarse sand with broken shale clasts, weathered brick and CLM		
				0.0				
-18								
-19	18-20	17,16,14,8	95	0.0		FILL: As above with wet, sticky, white clay covering the shale clasts		
				994		FILL: Damp, loose, black, fine sand with CLM, some slag-like material and a fuel-like odor		
-20								
-21	20-22	4,6,6,7	75	767				
				859	21.5	FILL: Moist, tan clay with shale clasts and interior black staining and a fuel-like odor		
-22								
-23	22-24	9,12,10,5	60	1637	22.5-23.8	FILL: Wet, *loose, porous, black* CLM with a green-tinted sheen, fuel-oil and tar-like odor, NAPL globules on water between 22.5-23.8		
				859				
-24								
-25	24-26	10,6,5,3	50	0.0		FILL: Moist, gray clay with interior staining and black, stringy material in clay, with a strong fuel-like odor and black, sticky, viscous, tar-like material, brick in shoe		
				0.0				
-26	26-28	50 for 3"	<5			FILL: Wet, loose, gray, fine to medium sand with gray clay, silt and rock clasts, slight fuel-like odor and organic, wood		
						WEATHERED BEDROCK: Moist, cohesive, gray clay with shale clasts. Refusal on bedrock at 26.3'		

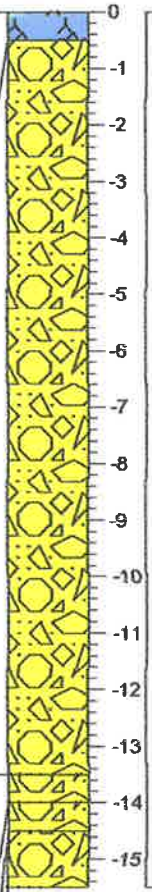
PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB14

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/27/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoon
GROUND ELEVATION:413.848 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 15.5 ft. below grade
WEATHER: Warm, light breeze, clear sky
GEOLOGIST:Amanda Bissell

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
0	0-2	2,7,12,13	60	0.0		TOPSOIL: Damp, loose, gray and brown, coarse to medium sand with root material and trace, brown clay		
-1				0.0				
-2	2-4	16,29,25,39	75	0.0		FILL: Damp to moist, loose, brown, medium to coarse sand with trace clay, fine, angular gravel, shale clasts and weathered brick		
-3				0.0				
-4	4-6	19,17,23,20	80	0.0				
-5				0.0				
-6	6-8	11,22,20,17	75	0.0				
-7				0.0				
-8	8-10	6,15,14,14	60	0.0				
-9				0.0				
-10	10-12	12,13,14,12	60	0.0				
-11				0.0				
-12	12-14	12,13,8,9	80	300				
-13				4,833				
-14	14-16	12,27, 50 for 1"	50	973	14-15.5	FILL: Damp, loose, black, very fine sand with coal-like material (CLM) and a slight fuel-like odor		
-15						FILL: Dry, very hard, yellow and white medium to coarse, clump sand		
						FILL: Dry, hard, black, sticky tar-like material (TLM) with CLM and a tar-like odor with brown sand, trace, brown clay and some concrete. Refusal at 15.5' below grade on 5' concrete pipe (03 discharge pipe)		



PID (ppm) = Photoionization Detector, readings in parts per million

WS-SB15

PROJECT: West Station - RG&E
PROJECT NO: I03039
LOCATION: Rochester, NY
DATE: 4/28/2006
DRILLING CONTRACTOR: Nothnagle Drilling
DRILLER: Kevin Busch
DRILLING METHOD: 4 1/4" Hollow-Stem Augers

SAMPLING METHOD:2' Split Spoon
GROUND ELEVATION:413.730 ft. above MSL
WELL ELEVATION:NA
OUTER CASING ELEVATION:NA
DEPTH TO WATER: NA
BOREHOLE DEPTH: 28 ft. below grade
WEATHER: Sunny, clear sky, light breeze, mild temperatures
GEOLOGIST:Amanda Bisseli

DEPTH (ft.)	SAMPLE INTERVAL (ft.)	Blow Count	% RECOVERY	PID (ppm)	ANALYTICAL SAMPLE	SOIL DESCRIPTION and LITHOLOGIC SYMBOL	WELL CONSTRUCTION	REMARKS
-14								
				767		FILL: Continuation of SB14, auger down to 12' bgs and begin sampling. Dry, hard, black, sticky tar-like material (TLM) with CLM and some slag-like material, and a strong tar-like odor with fine, black sand and weathered brick.		
-15	14-16	14,11,3,1	50					
				973	15.3			
-16								
				2,809				
-17	16-18	2,1,2,2	40					
				300	17-18	FILL: As above with ash-like material		
-18						FILL: Moist, loose, black sand with some slag-like material, brown clay and a very slight tar-like odor		
				300				
-19	18-20	Not recorded	>5					
				2,159				
-20								
	20-21	11,12	>5	973		FILL: Compact, hard, gray, coarse to medium sand with sandstone clasts and apparent concrete. Refusal at 21.2'		
-21								

PID (ppm) = Photoionization Detector, readings in parts per million