

**PATCHOGUE FORMER MANUFACTURED
GAS PLANT SITE
SUFFOLK COUNTY
PATCHOGUE, NEW YORK**

SITE MANAGEMENT PLAN

NYSDEC Site Number: 1-52-182

Prepared for:

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175 East Old Country Road
Hicksville, New York

Prepared by:

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Revisions to Final Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

February 2023

CERTIFICATION STATEMENT

I Marek Ostrowski certify that I am currently a NYS registered professional engineer and that this Interim Site Management Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Marek Ostrowski

P.E.

December 2, 2023

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**PATCHOGUE FORMER
MANUFACTURED GAS PLANT SITE
SUFFOLK COUNTY
VILLAGE OF PATCHOGUE, NEW YORK**

SITE MANAGEMENT PLAN

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List of Acronyms

AOC	Administrative Order on Consent
AST	Above-ground Storage Tank
BC	Brown and Caldwell
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
BUG	Brooklyn Union Gas
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulation
CP	Commissioner Policy
CY	Cubic Yards
DCR	Declaration of Covenants and Restrictions
DER	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
EC	Engineering Control
ECL	Environmental Conservation Law
ESD	Explanation of Significant Differences
EWP	Excavation Work Plan
FFS	Focused Feasibility Study
FSP	Field Sampling Plan
HASP	Health and Safety Plan
IC	Institutional Control
IHWDS	Inactive Hazardous Waste Disposal Site
ISS	In-Situ Stabilization
LILCO	Long Island Lighting Company
MGP	Manufactured Gas Plant
msl	Mean Sea Level
NAPL	Non-Aqueous Phase Liquid
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PRR	Periodic Review Report
PSA	Preliminary Site Assessment
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
RP	Remedial Party
SCDHS	Suffolk County Department of Health Services
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SDG	Sample Delivery Group

SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SPDI	Supplemental Pre-Design Investigation
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
VHB	Vanasse, Hangen, Brustlin
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Patchogue Former Manufactured Gas Plant (MGP) Site (herein referred to as “Site”), as well as the inspections, monitoring, maintenance and reporting intrusive activities required by this Site Management Plan (SMP):

Site Identification No. 1-52-182

Patchogue Former MGP Site, 234 West Main Street, Village of Patchogue,
Suffolk County, New York

Site Institutional Controls:	1. The Site may be used for restricted residential, commercial/industrial use in accordance with the Site use restrictions as well as the applicable local zoning regulations
	2. Environmental Easement a. Requires periodic certification of institutional or engineering controls b. Specifies development of property for restricted residential, commercial or industrial uses as defined in Part 375-1.8(g) and in accordance with local zoning regulations. c. Restricts use of groundwater as a potable or process water d. Prohibits vegetable gardens or farming; and e. Requires compliance with this Site Management Plan.
	3. ECs must be inspected at a frequency and in a manner defined in the SMP.
Site Engineering Controls:	1. Cover system
	2. Perimeter chain-link fencing with lockable gates
Inspections:	
1. Cover system inspection	Annually
2. Perimeter chain-link fencing with lockable gates	Annually

Monitoring:	
1. Groundwater Monitoring	Quarterly for 2 years; Semiannually years 3 through 5; Reevaluated after 5 years
2. Monitoring of Engineering and Institutional Controls	Annually
Maintenance:	
1. Cover system	As needed
2. Perimeter chain-link fencing with lockable gates	As needed
Reporting:	
1. Results of Groundwater Monitoring	Semi-Annually
2. Periodic Review Report (Certification of Engineering and Institutional Controls)	Annually

Further descriptions of the above requirements are provided in detail Sections 4.0 (Monitoring and Sampling Plan), 5.0 (Operation and Maintenance), and 7.0 (Reporting) of this Site Management Plan.

The Site is presently owned by KeySpan Gas East Corporation d/b/a National Grid. The present property owner and future property owners are required to comply with this SMP including all notifications to National Grid (as the Remedial Party) and to the New York State Department of Environmental Conservation (NYSDEC), and the provisions in the Excavation Work Plan (Appendix D). Should property ownership change after the submission of the SMP, then Institutional Controls (ICs) and any applicable Environmental Easements (EE) or Declaration of Convents and Restrictions (DCR) must be addressed and complied with by the property owner's successors.

Boundaries that are covered by this SMP will be reevaluated after the approval of the Final Engineering Report.

National Grid, as the Remedial Party, is responsible for Manufactured Gas Plant (MGP)-related impacts and costs associated therewith, only. If a remedy is determined to be necessary to address sources of non-MGP-related impacts present at the Site, this will be evaluated separately by NYSDEC, for further action. **While National Grid has voluntarily assumed responsibility for preparation of this SMP, National Grid reserves all of its rights under Federal and state environmental laws to pursue**

other parties who may have responsibilities at this Site and for violations of the SMP.

Further descriptions of the above requirements are provided in detail in the latter sections of this SMP.

SECTION 1

INTRODUCTION

1.1 General

This SMP is a required element of the remedial program for the Patchogue Former MGP located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (hereinafter referred to as the “Site”). Refer to Figure 1 for Site location. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site (IHWDS) Program, Site No. 1-52-182 which is administered by New York State Department of Environmental Conservation (NYSDEC).

The use of the Site as a former MGP has resulted in impacts to soils on an off-site property located immediately adjacent to (east of) the Site. This property, located at 212 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York will be herein referred to as the “Off-Site Property”. National Grid does not own this property. Refer to section 2.1.1 for Off-Site Property location, description and owner information.

KeySpan Gas East Corporation d/b/a National Grid (is presently the owner of the Site and the Remedial Party (RP, also known as the Respondent) to an Administrative Order on Consent (AOC), dated September 30, 1999 with the NYSDEC to remediate the Site. The Site location and boundaries of this Site are provided in Figures 1 and 2. The boundaries of the Site are fully described in the metes and bounds Site description as part of the Environmental Easement. The Environmental Easement is provided in Appendix A. The Environmental Easement is granted by the present owner of the Site (the “Grantor”) to the NYSDEC.

After completion of the remedial work, some MGP-related impacts remain in the subsurface at the Site and the Off-Site Property. Institutional and Engineering Controls (ICs and ECs) are incorporated into the Site remedy to control exposure to remaining MGP-related impacts to ensure protection of public health and the environment. An Environmental Easement was granted to the NYSDEC, by National Grid and recorded with the Suffolk County Clerk, which requires compliance with this SMP and all established ECs and ICs for the Site.

ECs and ICs were incorporated into the remedy for the Site to control exposure to

remaining MGP-related impacts to ensure protection of public health and the environment. The ECs include stone cover system as well as chain-link fencing with lockable gates. ICs consist of the Environmental Easement granted to the NYSDEC by National Grid and recorded with the Suffolk County Clerk which requires compliance with the SMP and the ECs and ICs for the Site.

Post-remedial monitoring including groundwater monitoring and periodic EC inspections will be conducted to determine the success of the remedy and to assess compliance with the provisions of the Environmental Easement and this SMP.

ECs and ICs were also incorporated into the Remedy for the Off-Site Property to control exposure to remaining MGP-related impacts to ensure protection of public health and the environment. The ECs on the Off-Site Property include the asphalt pavement cap/surface, perimeter chain-link fencing, and building concrete slab cover system. The Off-Site Property will have the similar post-remedial monitoring as described above for the Site with regard to the cover systems.

The Off-Site Property Owner will be responsible to maintain the asphalt and building cover systems to address normal wear and tear and shall replace the asphalt if broken during activities conducted on the Off-Site Property (e.g., utility installation). To memorialize the SMP, the Off-Site Property owner executed a Declaration of Covenants and Restrictions (DCR), dated May 10, 2016 and recorded on June 17, 2016 at the Suffolk County Clerk in Liber D00012868, Page 427.

This SMP was prepared to manage remaining MGP-related impacts at the Site in accordance with Environmental Conservation Law (ECL) Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the Grantor of the Environmental Easement and the Grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement;
- Failure to comply with this SMP is also a violation of Environmental

Conservation Law, 6NYCRR Part 375 and the Order on Consent (Index #D1-001-99-05; Site #1-52-182) for the Site, and thereby subject to applicable penalties.

Reports associated with the Site and the Off-Site Property can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in NYS. A list of contacts for persons involved with the Site and the Off-Site Property is provided in Appendix B of this SMP.

This SMP was prepared by Brown and Caldwell Associates (BC), on behalf of National Grid, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and ECs at the Site that are required by the Environmental Easement.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager as an addendum. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, removal of impacted soil, or other significant change to the Site conditions. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the SMP and append these notices to the SMP that is retained in its files.

1.3 Notifications

1.3.1 Site Notification Requirements

Notifications will be submitted by the property owner (currently National Grid) to the NYSDEC and National Grid (by subsequent property owners), as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in Site use that are required under the terms of the Order on Consent, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 30-day advance notice of any field activity pursuant to the Excavation Work Plan (Appendix D).

- 45-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Notice will be provided to NYSDEC within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Notice will be provided to NYSDEC by verbal notice by noon of the following day of any emergency, such as a fire, flood or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any proposed change in the ownership of the Site, use of the Site, or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC and National Grid (in the case of subsequent property owners) will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party (RP, also known as the Respondent) has been provided with a copy of the Order on Consent, the Record of Decision (ROD), and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC and National Grid.

Table 1A includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B.

Table 1A: Site Notifications*

Name	Contact Information
Gerald Pratt, NYSDEC Project Manager	(518) 402 9667 gerald.pratt@dec.ny.gov
Michael Quinlan, National Grid Project Manager	(516) 220-4363 michael.quinlan@nationalgrid.com
NYSDOH Public Health: Jacquelyn Nealon	(518) 402-7860; Jacquelyn.nealon@health.ny.gov

* Note: Notifications are subject to change and will be updated as necessary.

1.3.2 Off-Site Property Notification Requirements

Notifications will be submitted by the Off-Site Property owner to National Grid and the NYSDEC, as needed, for the following reasons:

- 60-day advance notice of any proposed changes in the use of the Off-Site Property.
- 45-day advance notice of any proposed ground-intrusive activity to be conducted on the Off-Site Property pursuant to the Excavation Work Plan.
- Within 48-hours of any damage or defect to the foundation, structures or EC on the Off-Site Property that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire, flood or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Off-Site Property, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Submit follow-up status reports on actions taken to respond to any emergency event on the Off-Site property requiring ongoing responsive action submitted within 45 days describing and documenting actions taken to restore the effectiveness of the ECs on the Off-Site property.

Any proposed change in the ownership of the Off-Site Property, use of the Off-Site Property, or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, NYSDEC and National Grid will be notified in writing of the proposed change. This will include a certification that the prospective purchaser has been provided with a copy of this SMP.
- Within 15 days after the transfer of all or part of the Off-Site Property, the new owner's name, contact representative, and contact information will be confirmed in writing.

Table 1B includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B.

Table 1B: Off-Site Property Notifications*

Name	Contact Information
Michael Quinlan, National Grid Project Manager	516-220-4363 michael.quinlan@nationalgrid.com

* Note: Notifications are subject to change and will be updated as necessary.

SECTION 2

SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Location and Description

2.1.1 Site Location and Description

The Site is located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York and is identified as District 204 Section 12 Block 9 and Lot 6.4 on the Village of Patchogue Tax Map (see Figure 2). The Site is an approximately 3.6-acre area with a maximum length (north-south) of approximately 680 feet and a maximum width (east-west) of 180 feet, and is bounded to the north by West Main Street, beyond which is a property occupied by Blue Point Brewing Company and Patchogue Lake; to the east by an unpaved access driveway and two commercial properties, beyond which is an undeveloped property owned by the Town of Brookhaven and then the Patchogue River; to the south by a residential area and an overflow pond to the south/southwest; and to the west by a steep slope, beyond which are a residential area and municipal storage yard. The Site has relatively flat topography with a typical elevation of approximately five feet above mean sea level (msl). The boundaries of the Site are more fully described in Appendix A (Environmental Easement). Site property boundaries are provided on Figures 2 and 3. The owner(s) of the Site parcel(s) at the time of issuance of this SMP are: KeySpan Gas East Corporation d/b/a National Grid, 175 East Old Country Road, Hicksville, New York 11801.

2.1.2 Off-Site Property Location and Description

The Off-Site Property is located at 212 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York and is identified as District 204 Section 12 Block 9 and Lot 67.1 on the Village of Patchogue Tax Map (see Figure 2). The Site is an approximately 0.9-acre area with a maximum length (north-south) of approximately 230 feet and a maximum width (east-west) of 260 feet, and is bounded to the north by West Main Street, beyond which is a property occupied by Blue Point Brewing Company and Patchogue Lake; to the east an undeveloped property owned by the Town of Brookhaven, beyond which is the Patchogue River, to the south by a portion of the Site and the Patchogue River; and to the west by the Site beyond which are a residential area and municipal storage yard. The Off-Site property has relatively flat topography with a typical

elevation of approximately five feet above mean sea level (msl). The Off-Site Property and boundaries are provided on Figure 3. The owner of the Off-Site Property at the time of issuance of this SMP is 210 West Main Realty Corp., 50 Gilpin Avenue, Hauppauge, New York 11788.

2.2 Physical Setting

2.2.1 Site Land Use

The Site is informally divided into three areas: the Northern Area, the Central/Core Area, and the Southern Area. The Northern Area is a rectangular area comprising the northern portion of the Site. This area is clear of vegetation and the ground surface is composed of two adjacent concrete slabs with a combined size of approximately 240 feet by 60 feet. The Central/Core area consists of the central portion of the Site where the majority of the former MGP structures were located. The Central/Core area is also rectangular in shape. This area currently has a crushed stone cover and a concrete stormwater swale along the eastern side. A steep slope runs along the western boundary of the Site. The Southern Area comprises the tapered southern end of the property. This area is densely vegetated.

The properties adjoining the Site and surrounding the Site primarily include commercial, residential, and industrial properties. The properties immediately south of the Site include residential properties; the properties immediately north of the Site include commercial/industrial properties; the properties immediately east of the Site include an vacant commercial building and the Patchogue River; and the properties to the west of the Site include residential properties and commercial business. The River Avenue Elementary School is located approximately one-tenth of a mile southwest and upgradient of the Site, with residential homes between the Site and the school. The Village of Patchogue's wastewater treatment plant (WWTP) is located to the east of the Site beyond the adjacent commercial property and the Patchogue River.

The existing conditions at the Site are shown in Figure 3.

2.2.2 Site Geology

The Site is generally flat with an elevation of approximately five feet above msl. A layer of crushed stone, varying from two to four feet thick, covers the Central/Core area of the Site. Below the crushed stone surface, the existing fill varies in thickness but is typically

up to three feet thick. Beneath the fill is a layer of alluvial deposits which are likely floodplain sediments associated with the Patchogue River. These deposits consist of layers of sands, silts, clays and organic material, including peat deposits. Much of the sand in the alluvial deposits is likely derived from the underlying sand unit and locally the alluvial deposits can be similar in character to this underlying unit. The alluvial deposits are generally thin and are locally discontinuous. Underlying the alluvial deposits is a unit of sand with varying amounts of gravel. This unit is likely glacial outwash deposits deposited during the Pleistocene Epoch. The sand unit extends to a depth of at least 30 feet below ground surface (bgs), which was the depth of the deepest borings drilled during the Site investigation activities.

2.2.3 Post-Remediation Stratigraphy and Geology

In the center of the Central/Core area below the crushed stone surface is solidified mass comprised of the site soils (fill, alluvial deposits, sand) mixed and solidified with a low percentage of Portland cement. The solidified mass extends to varying depths from 7 feet to 23 feet below grade.

Geologic cross section locations are shown in Figure 4A. The geologic cross-sections are shown on Figure 4B. Site specific boring logs are provided in Appendix C.

2.2.4 Site Hydrogeology

The water table is shallow at the Site typically ranging from between less than one foot to about five feet bgs. Groundwater flow is toward the south-southeast direction and discharges to the Patchogue River. Where it is saturated with groundwater, the glacial outwash unit described above is referred to regionally as the “upper glacial aquifer”. On-site groundwater is not utilized as a drinking water source. The Village of Patchogue is serviced by a public, municipal water source. The Village of Patchogue’s Department of Public Works indicated that the installation of private water wells is prohibited.

A groundwater contour map is shown in Figure 5. Groundwater elevation measurements are provided in Table 2. Groundwater monitoring well construction logs are provided in Appendix C.

2.3 Site Investigations and Remedial History

The following narrative provides a remedial history timeline and a brief summary

of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Table 3 and Section 8.0 - References.

2.3.1 Site History

The Site was operated as a MGP from 1904 to 1926. MGPs such as this converted coal and/or petroleum products to a flammable gas which was used in the surrounding community in much the same way that natural gas is used today.

The Site was owned and operated by the Patchogue Gas Company either independently (1904 through 1926) or, from 1927, under ownership of the Long Island Lighting Company (LILCO). The MGP was constructed by the Patchogue Gas Company in approximately 1904. Identification of retorts on the earliest Sanborn Fire Insurance (Sanborn) Maps indicates that the initial gas production activities included the coal gasification process, although in Browns Directory it was reported that the Lowe water gas process was used. Furthermore, a boiler, which is a component of the water gas process, is depicted on the Sanborn map. Routine production of manufactured gas ended in 1914, and from 1922 to 1925, the facility was used for emergency gas production. In 1914, the facility was modified to store and distribute high pressure gas produced at other facilities. High pressure gas stored at and distributed from the Site was purchased from Suffolk Gas & Electric (Bay Shore) from 1915 through 1917 and from 1918, the gas supplier is identified only as LILCO. From 1922 through 1925, emergency gas production occurred at the Site.

Review of a 1926 Sanborn Map included in the Preliminary Site Assessment (PSA) Report (Vanasse, Hangen, Brustlin [VHB], 2002) indicated a group of seven horizontal aboveground storage tanks (ASTs) were installed sometime after 1910. According to documentation from KeySpan (now National Grid), these ASTs were used for additional gas storage capacity at the Site and are incorrectly labeled as “oil tanks” on the Sanborn Maps.

The 60,000 cubic foot gas holder, initially present on the Site, was consistent with the limited production of manufactured gas at the facility; larger manufactured gas production operations would likely have required additional and larger gas holders. A gas sphere present at the Site during later operations stored gas under high pressure and was consistent with the use of the Patchogue facility for distribution of gas produced elsewhere.

The distribution facility remained until the 1970s when LILCO sold the property to third parties. From the mid-1970s through early 2005, the Site was used as a refrigeration equipment and scrap storage yard. LILCO was acquired by Brooklyn Union Gas (BUG) in 1999 and the two merged to form KeySpan Corporation, who acquired the Site in 2005 for purposes of remediation. National Grid acquired KeySpan in 2007 and currently maintains ownership of the Site.

On September 30, 1999, KeySpan Gas East Corporation entered into Order on Consent D1-001-99-05 with NYSDEC to conduct a PSA of the Former Patchogue MGP Site. The PSA was conducted in 2001 and the results were documented and submitted to the NYSDEC in March 2002 in the PSA Report (VHB, 2002). In 2008 and 2009, remedial investigation (RI) activities were performed and the results were documented and submitted to the NYSDEC in the Remedial Investigation Report (RIR) (TetraTech EC, December 2009).

2.3.2 Regulatory and Remedial Investigation History

The history of the Site, the findings from the assessment and investigation activities into the subsurface conditions and the nature and extent of MGP-related impacts at the Site, and remedial design activities and remedy implementation are presented in the documents listed on Table 3. The Site documents (including all NYSDEC reports are on file with the NYSDEC and at the Patchogue Medford Library in Patchogue, New York).

2.3.3 Impacted Media and Contaminants of Concern

2.3.3.1 Site

The locations where MGP impacts were observed during the investigation activities are concentrated in the former locations of the MGP-related structures such as the gas holder, purifier house boiler, and tanks in the Central/Core Area of the Site. These impacts were observed in the subsurface soils, predominantly in the upper ± 10 feet of soil. Locally, these impacts were present at depths up to nearly 23 feet bgs, although the intervals of deeper impact are thin and less frequent.

Groundwater sampling conducted during remedial investigations and quarterly monitoring activities indicated that dissolved phase benzene, toluene, ethylbenzene and xylene (BTEX) and polycyclic aromatic hydrocarbon (PAH) compounds are present at concentrations above the Class GA groundwater quality criteria in the Central/Core Area of

the Site. These elevated groundwater concentrations coincided with the locations where dense non-aqueous phase liquid (DNAPL) was encountered in the subsurface.

As indicated in the RIR, the RI investigation indicates surface soil, soil vapor, and surface water are not significant contaminant transport mechanisms. In addition, the RIR and the evaluation of the Patchogue River sediments discussed in the on-site conceptual model also supported that sediment is not a medium of concern at the Site.

In summary, based on the findings of the Site investigations (i.e., the PSA, RI and PDI/SPDIs), exposure assessments and the evaluation of the river sediments, the impacted media that were addressed in the focused feasibility study (FFS) included surface soils, subsurface soil, source material, and groundwater. The surface soils included the areal extent of the portion of the Site subject to previous filling activities and the former MGP operations area (the Central/Core Area of the Site). The surficial soils included soils to a depth of two feet. This layer included impacted areas presumably from the former MGP operations and other historical Site activities. The impacted subsurface soils included those soils in the two portions of the Central/Core Area (i.e., the relatively large area occupying the central and northeastern part of the Central/Core Area, and the smaller area in the northwestern corner of the Central/Core Area). The depth of impacted soil ranged from ground surface to nearly 23 feet bgs. The impacted soil contained DNAPL and associated stains, sheens and odors, as well as concentrations of BTEX and PAH compounds above soil cleanup objectives (SCOs). MGP-related source material (source material) is considered to be the DNAPL identified during visual observations noted as part of the investigation activities and described in the boring logs as blebs, soils partially coated to saturated with DNAPL and DNAPL globs. MGP-impacted source material were the contaminants of concern and the source material of impacts to soils and groundwater. Petroleum impacts, noted through visual and olfactory observations during the investigation activities, were co-mingled with the MGP-related impacts.

MGP-related constituent concentrations in groundwater are anticipated to attenuate by the remediation of MGP-impacted source material as the potential source of dissolved-phase impacts to groundwater.

2.3.3.2 Off-Site Property

Releases from process equipment, tanks and piping during the former transfer and distribution processes may have resulted in MGP-related impacts in off-site soils. MGP-related DNAPL consisting of black viscous, tacky, stringy tar-like material that partially coats the sand grains and exhibits a moderate naphthalene-like odor, was observed at investigation locations on the Off-Site Property adjacent to the Patchogue Former MGP Site. Petroleum impacts, noted through visual and olfactory observations during the investigation activities, were co-mingled with the MGP-related impacts.

MGP-related constituent concentrations in groundwater are anticipated to attenuate by the remediation of MGP-impacted source material as the potential source of dissolved-phase impacts to groundwater.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the ROD dated March 31, 2011 are as follows:

2.4.1 Public Health Protection

1. Groundwater: Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
2. Soil: Prevent ingestion/direct contact with contaminated soil.
3. Soil Vapor: Address exposures to the public related to soil vapor intrusion into buildings.

2.4.2 Environmental Protection

1. Groundwater: Remove the source of ground or surface water contamination. Restore the groundwater aquifer to meet ambient groundwater quality criteria, to the extent feasible.
2. Soil: Prevent migration of contaminants that would result in groundwater or surface water contamination.

3. Non-Aqueous Phase Liquid (NAPL): Remove free product/NAPL identified at the site to the extent technically practicable. Eliminate through removal, treatment, and/or containment the free product/NAPL as source of contamination to other environmental media.
4. Soil Vapor: Eliminate, to the extent practicable, the impact of contaminants in soil or groundwater to soil vapor.

2.5 Selection and Implementation of Remedy

The NYSDEC selected the remedy for the Patchogue Former MGP Site based on the results of the evaluation detailed in the 2011 FFS and the public's input into the Proposed Remedial Action Plan (PRAP), as documented in the ROD. The remedy was subsequently modified as presented in the 2017 Explanation of Significant Differences (ESD). The final components of the implemented remedy consisted of the components described below.

Excavations

- Any existing former MGP structures (i.e., piping), debris, and major obstructions (i.e., railroad), to allow for treatment of underlying soils and installation of a soil cover.
- On-Site fill materials to a depth of at least two feet bgs over the entire Central/Core Area (beyond the limits of the in-situ solidification [ISS] area) to allow for installation of a two-foot thick surface cover.
- Soils in an area of approximately 40-feet long by 20-feet wide located along the west-southwest portion of the on-Site remedial area, to the depth of four-feet bgs. The area was be backfilled with certified clean stone and a two-foot thick stone cover was installed.
- The excavations were backfilled with certified imported clean stone that met the 6 NYCRR 375-6.7(d) restricted-residential criteria for backfill.

ISS of Soil

- MGP-related source material and existing soils were mixed in-place with Portland cement to form a solid mass with low hydraulic conductivity relative to surrounding soils to prevent migration of MGP-related contaminants and to encapsulate the impacts. The horizontal and vertical extents of the ISS area were determined utilizing the results of investigation activities ended to encapsulate the impacts.
- Following ISS treatment, the top four feet of the solidified material was excavated to accommodate the installation of the Site cover. The excavated material was transported and disposed off-Site at a licensed disposal facility.
- The area was backfilled with four feet of clean stone.

Cover Systems

A Site Cover was installed to allow for restricted-residential use of the Site. The Site was restored generally to pre-existing grades. The Site Cover was installed in areas where the upper two feet of exposed surface soil exceed the applicable SCOs. The soil cover consists of a minimum of two feet of crushed stone meeting the requirements for cover material set forth in 6 NYCRR Part 375-6.7(d). The Site Cover was placed over an orange-colored geotextile fabric that serves as a visible demarcation layer.

Institutional Control

- Implementation of an institutional control in the form of an environmental easement for the Site and the Off-Site Property that:
 - Requires the remedial party or site owner to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
 - Allows the use and development of the controlled property for restricted residential, commercial and industrial uses or as defined by Part 375-1.8(g), though land use is subject to local zoning laws;
 - Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDEC, the New York State Department of Health (NYSDOH) or the Suffolk County Department of Health Services (SCDHS);
 - Prohibits agriculture or vegetable gardens on the controlled property; and

- Requires compliance with the NYSDEC approved Site Management Plan.

Site Management Plan

- An Institutional and Engineering Control Plan that identifies use restrictions and engineering controls for the Site and the Off-Site Property and details the steps and media-specific requirements necessary to allow the following institutional and/or engineering controls to remain in place and effective.

2.6 Remaining Contamination

2.6.1 Site Soils

Table 4A and Figure 6 summarize the results of remaining MGP-related on-site impacts that exceed the Restricted Residential Use after completion of remedial action. One or more PAH compounds exceed the applicable SCOs at eight on-site soil boring locations; no exceedances of BTEX were observed at these locations.

2.6.2 Off-Site Property Soils

Table 4B and Figure 6 summarize the results of remaining MGP-related impacts on the Off-Site property that exceed the Restricted Residential Use SCOs, after completion of remedial action. One or more PAH compounds exceed the applicable SCOs at one soil boring location; no exceedances of BTEX were observed at this location.

2.6.3 Groundwater

Isolated constituent concentrations were detected above Class GA groundwater quality criteria at monitoring locations proximal to the ISS mass during the post-remediation sampling events conducted in March, June and December 2020. The presence in groundwater of these constituents is an expected result of the disturbance of the subsurface during implementation of the ISS. Prior to remediation in the area downgradient of the MGP-related source materials, these constituents were either not detected or detected at concentrations below Class GA groundwater quality criteria in the wells that existed prior to remedy implementation. These concentrations are anticipated to decrease with time since the DNAPL-impacted soils (i.e., MGP-related source materials) have been remediated. Groundwater monitoring activities will continue at the Site to assess natural attenuation, as determined by the NYSDEC, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the Site Standards, Criteria and Guidelines (SCGs), or have become asymptotic at an acceptable level over an extended

period.

SECTION 3

INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

ICs and ECs are required to protect human health and the environment. This IC/EC Plan describes the implementation and management of IC/ECs at the Site. The IC/EC Plan is one component of this SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of IC/ECs on the Site and the Off-Site Property;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement for the Site as well as the DCR for the Off-Site Property;
- ;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix D) for the proper handling of remaining MGP-related impacts that may be disturbed during maintenance or redevelopment work on the Site;
- A description of the roles and responsibilities of each party with respect to this SMP; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the remedy, as determined by the NYSDEC.

3.2 Institutional Controls

3.2.1 Site Institutional Controls

A series of ICs is required by the ROD to be implemented at the Site: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to remaining MGP-related impacts; and (3) limit the use and development of the Site to restricted residential, commercial and industrial uses only. Adherence to these ICs on the Site is required by the Environmental Easement. ICs identified in the Environmental Easement may not be

discontinued without an amendment to or extinguishment of the Environmental Easement.

The IC boundaries are shown on Figure 7. These ICs are:

- The RP (Respondent) or Site Owner is to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
- The property may be used for: restricted residential, commercial and industrial use or as defined by Part 375-1.8(g), though land use is subject to local zoning laws;
- ECs must be operated and maintained by National Grid as specified in Section 4.0 of this SMP;
- ECs must be inspected at a frequency and in a manner defined in Section 7.0 of the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Suffolk County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in Section 4.0 of this SMP;
- Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in Section 7.0 of this SMP;
- Future intrusive activities that will disturb remaining MGP-related impacted material must be conducted in accordance with the Excavation Work Plan provided as Appendix D of this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in Section 6.0 of this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in Section 4.0 of this SMP;
- Access to the Site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the

Environmental Easement (to be established after implementation of the remedy);

- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 9, and any potential impacts that are identified must be monitored or mitigated;
- Vegetable gardens and farming on the Site are prohibited;
- Must comply with the Department approved SMP; and
- Must comply with the Department approved Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP).

3.2.2 Off-Site Property Institutional Control

ICs implemented at the Off-Site Property which are agreed to between National Grid and the present owner of the Off-Site Property include: (1) implement, maintain and monitor the ECs; (2) prevent future exposure to remaining MGP-related impacts; and, (3) limit the use and development of the Off-Site Property to restricted residential, commercial and industrial uses. The Off-Site Property owner executed a DCR (referenced in Section 1.1) to memorialize the SMP. The IC boundaries are shown on Figure 7. The ICs are:

- The RP (Respondent) is to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
- The Off-Site Property may be used for: restricted residential, commercial and industrial use or as defined by Part 375-1.8(g), though land use is subject to local zoning laws;
- ECs must be operated and maintained by the Owner through notification to National Grid as specified in Section 4.0 this SMP;
- National Grid will inspect at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the Off-Site Property will be prohibited without prior approval of NYSDEC in order to ensure it is safe for use as drinking water or for industrial purposes. The owner of the Off-Site Property must first notify and obtain written approval to do so from the NYSDEC, NYSDOH, and SCDOH;

- Groundwater and other environmental or public health monitoring must be performed as defined in Section 4.0 this SMP;
- Data and information pertinent to management of the Off-Site Property must be reported at the frequency and in a manner as defined in Section 7.0 this SMP;
- The Owner of the Off-Site Property must notify National Grid prior to future intrusive activities that will disturb remaining MGP-related impacted material. The invasive activities must be conducted in accordance with the EWP provided in Appendix D of this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in Section 6.0 this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in Section 4.0 this SMP;
- Pursuant to the DCR, access to the Off-Site property shall be provided to National Grid and agents, employees, or other representatives of the State of New York with reasonable prior notice to the owner of the Off-Site Property to assess compliance with the restrictions identified by the DCR and this SMP;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 9, and any potential impacts that are identified must be monitored or mitigated;
- Vegetable gardens and farming on the Off-Site Property are prohibited;
- Must comply with the DCR and the provisions of this SMP; and
- Must comply with HASP prepared for the site-specific activity and in compliance with the NYSDOH Generic CAMP (Appendix F).

3.3 Engineering Controls

The following ECs were implemented as part of the Site remedy on the Site and the Off-Site Property.

3.3.1 On-Site Engineering Controls

3.3.1.1 On-Site - Stone Cover System

Exposure to remaining MGP-related impacts at the Site is prevented by a stone cover system placed over the Site. The stone cover system comprises a minimum of two feet of clean backfill. Figure 7 presents the location of the cover system. The EWP provided in

Appendix D outlines the procedures required to be implemented in the event the cover system is breached, penetrated, or temporarily removed and any underlying remaining MGP-related impacts are disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a HASP and associated CAMP prepared for the Site-specific task.

3.3.1.2 On-Site – Perimeter Fencing with Lockable Gates

Access to the Site is restricted by fencing with lockable gates installed along the perimeter of the Site. The fence is 6 feet in height. Figure 7 presents the location of the fencing. Procedures for the inspection of the fencing are documented in the Monitoring and Sampling Plan (Section 4.0 of this SMP).

3.3.2 Off-Site Property Engineering Controls – Asphalt Pavement and Building Cover Systems

Exposure to the remaining MGP-related impacts on the adjacent Off-Site Property is minimized by the presence of the building and its foundation system as well as an asphalt pavement cover system. Figure 7 presents the location of the cover systems. Procedures for the inspection of the asphalt pavement cover are documented in the Monitoring and Sampling Plan (Section 4.0 of this SMP).

3.3.3 Off Site – Perimeter Fencing with Lockable Gates

Access to the Off-Site is restricted by fencing with lockable gates installed along the perimeter of the Site. The fence is 6 feet in height. Figure 7 presents the location of the fencing. Procedures for the inspection of the fencing are documented in the Monitoring and Sampling Plan (Section 4.0 of this SMP).

3.3.4 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered complete when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

3.3.4.1 Site - Stone Cover System

The on-site stone cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.3.4.2 Site – Perimeter Fencing with Lockable Gates

The on-site fencing system is a permanent control and the quality and integrity of this system, will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.3.4.3 Off-Site Property – Building and Asphalt Cover System

The building concrete slab cover system and the asphalt pavement cover system on the Off-Site Property is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.3.4.4 Off-Site Property – Perimeter Fencing with Lockable Gates

The off-site fencing system is a permanent control and the quality and integrity of this system, will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.3.4.5 Monitoring Wells associated with Monitored Natural Attenuation

National Grid, as the RP, will perform post-remediation groundwater monitoring activities, via a monitoring well network, on the Site and the Off-Site Property to assess natural attenuation will continue, as determined by the NYSDEC in consultation with NYSDOH, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the Site SCGs, or have become asymptotic at an acceptable level over an extended period. In the event that monitoring data indicates that monitoring for natural attenuation may no longer be required, a proposal to discontinue the system will be submitted by the RP. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

It is the responsibility of the owner of the Off-Site Property to provide National Grid (or subsequent property owners) access to the monitoring wells located on the Off-Site Property. National Grid (or subsequent property owners) will supply the Off-Site Property owner with a minimum of three days' notice prior to the need to access the wells.

SECTION 4

MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy on both the Site and the Off-Site Property. National Grid maintains responsibility for implementing the requirements of the Monitoring and Sampling Plan. The owner of the Off-Site Property maintains the notification requirements included in this SMP. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. National Grid maintains responsibility to present proposed revisions of the plan to the NYSDEC and gain their approval. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for samples collected as part of Site management for the Site are included in the Quality Assurance Project Plan (QAPP) provided in Appendix G.

This Monitoring and Sampling Plan, to be implemented by National Grid, describes the methods to be used for:

- Sampling and analysis of groundwater via wells located on the Site as well as on the Off-Site Property;
- Monitoring of the cover systems on the Site and the Off-Site Property;
- Monitoring of the perimeter fencing and lockable gates on the Site;
- Assessing compliance with applicable NYSDEC SCGs, particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating Site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;

- Inspection and maintenance requirements for the soil and asphalt cover;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site-Wide Inspection

A comprehensive site-wide inspection will be performed by National Grid's Qualified Environmental Professional (QEP) on both the Site and the Off-Site Property and documented annually by National Grid. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed by National Grid's QEP after severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix H – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with ICs, including usage of the Site and the Off-Site Property;
- An evaluation of the condition and continued effectiveness of ECs located on the Site and the Off-Site Property;
- General conditions of the Site and the Off-Site Property at the time of the inspection;
- The management activities being conducted on the Site and the Off-Site Property including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that Site and Off-Site Property records are up to date.

Inspections of ECs installed at the Site and the Off-Site Property will be conducted by National Grid's QEP. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs located on the Site and the Off-Site Property continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement established on the Site;
- Compliance with requirements of this SMP and the DCR established on the Off-Site Property;
- Achievement of remedial performance criteria; and
- If Site and Off-Site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed by National Grid's QEP on the Site and the Off-Site Property in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the Site or the Off-Site Property, once National Grid is notified by 210 West Main Realty Corp., verbal notice to the NYSDEC, by National Grid once notified, must be given by noon of the following day, to the extent possible. In addition, an inspection of the Site and the Off-Site Property will be conducted by National Grid's QEP within 5 days of the event to verify the effectiveness of the ICs and ECs. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public. This confirmation will be made by National Grid.

4.3 Post-Remediation Monitoring and Sampling

National Grid's QEP will collect groundwater samples from the monitoring wells located on the Site and the Off-Site Property on a quarterly basis for the first two years, then on a semi-annual basis for years three through five following implementation of the site remedy. Sampling locations, required analytical parameters, and schedule are provided in Table 5 – Post Remediation Groundwater Sampling Requirements and Schedule.

The long-term monitoring schedule for the Site includes quarterly sampling of 18 wells for the first two years. From Year three through Year five, semi-annual sampling of the wells, except for MW-12D and MW-13D, will be performed. After year five, monitoring frequencies will be reevaluated based on analytical data on a per-well basis.

Any proposed modifications will be implemented in collaboration with the NYSDEC.

Sample collection and analytical procedures and protocols are provided in Appendix I – Generic Field Sampling Plan (FSP) and Appendix G – Generic QAPP.

4.3.1 Groundwater Sampling

Groundwater monitoring will be performed by National Grid’s QEP using the monitoring wells located on the Site and the Off-Site Property on the schedule specified above (Section 4.3.1) to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

This proposed monitoring network will allow for: 1) long-term verification of the extents of the MGP-related dissolved-phase impacts within the two water-bearing zones identified at the Site; and 2) tracking of groundwater quality improvements within these two hydrostratigraphic units following implementation of the site remedy.

Table 6 summarizes the well identification numbers, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the post-remediation groundwater monitoring, upgradient wells, on-site wells and downgradient wells are sampled to evaluate the effectiveness of the remedial system. Monitoring well construction logs are included in Appendix C.

If biofouling or silt accumulation occurs in the monitoring wells, the wells will be physically agitated/surged and redeveloped by National Grid’s QEP. Additionally, monitoring wells will be properly decommissioned and replaced by National Grid’s QEP, if an event renders the wells unusable.

Repair and/or replacement of wells in the monitoring well network will be performed by National Grid’s QEP based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC’s guidance

entitled “CP-43: Groundwater Monitoring Well Decommissioning Procedures.” Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC. Deliverables for the groundwater monitoring program are specified in Section 7.0 - Reporting Requirements.

4.3.2 Monitoring and Sampling Protocol

Sampling activities will be recorded by National Grid’s QEP in a field book and associated sampling log as provided in Appendix H - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the Generic FSP provided as Appendix I of this document.

4.4 Engineering Control Monitoring

The cover systems and the perimeter fencing with lockable gates at the Site and the cover systems on the Off-Site Property provide a physical barrier over remaining MGP-related impacts. Annual inspections of these ECs will be performed by National Grid’s QEP in order to determine their integrity, operability, and effectiveness. The ECs will be inspected to document that they continue to function as designed and intended to protect public health and safety and the environment. National Grid’s QEP will conduct the inspections of the ECs on the Site and the Off-Site Property. Correction of deficiencies and/or required maintenance will be conducted in a timely manner by National Grid for the ECs on the Site.

The Owner of the Off-Site Property will maintain responsibility to monitor and maintain the ECs on the Off-Site Property. Each, alteration, excavation, or disturbance of the ECs is to be addressed appropriately and in a timely manner to maintain the integrity of the engineering control. A record of inspections will be maintained by National Grid, including the inspection dates, name of the inspector, and results of inspection. During these inspections, an inspection form will be completed as provided in Appendix H – Site Management Forms.

SECTION 5

OPERATION AND MAINTENANCE PLAN

5.1 General

The remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to be constructed on the Site or the Off-Site Property to protect public health and the environment. Therefore, the operation and maintenance of such components are not included in this SMP. As such, National Grid does not anticipate maintaining responsibility regarding the operation or maintenance of any active post-remedial systems.

SECTION 6

PERIODIC ASSESSMENTS/EVALUATIONS

Periodic assessments/evaluations of the effectiveness of the implemented remedy and the post-remedy implementation conditions of the Site and the Off-Site Property are to be conducted in accordance with the requirement of this SMP. National Grid will maintain responsibility to perform these assessments/evaluations on the Site and the Off-Site Property.

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the Site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding. A vulnerability assessment was performed as part of the final design of the remedy including the stormwater management practices as well as the placement of post-remedial groundwater monitoring wells.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the Site and the Off-Site Property during management of these sites, and as reported in the Periodic Review Report (PRR).

National Grid maintained responsibility to perform the Green Remediation Evaluation before during the investigation activities, during remedy design and implementation, and will maintain responsibility throughout the duration of the management activities covered under this SMP on the Site and the Off-Site Property.

The green aspects that will be evaluated are listed below.

- Water Conservation
- Energy Conservation
- Impact to Community

6.2.1 Timing of Green Remediation Evaluations

For post-remedial activities, green remediation evaluations and corresponding modifications, if necessary, will be performed by National Grid.

Modifications resulting from green remediation evaluations will be routinely implemented by National Grid, as necessary, on both the Site and the Off-Site Property and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR. No major remedial system components remain on the Site and the Off-Site property after implementation of the remedy.

6.2.2 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site and the Off-Site Property and use of consumables in relation to visiting the Site and the Off-Site Property in order to evaluate the conditions of the engineering controls, changes in Site/Off-Site Property usage and/or to collect samples, and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities will be prepared by National Grid so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

SECTION 7

REPORTING REQUIREMENTS

7.1 Site Management Reports

Site management inspection, maintenance and monitoring events will be recorded by National Grid's QEP on the appropriate Site Management Forms provided in Appendix H. These forms are subject to revision by the NYSDEC for use on the Site or by National Grid for use on the Off-Site Property.

Applicable inspection forms and other records, including groundwater sampling reports, generated for the Site and the Off-Site Property by National Grid during the reporting period will be provided in electronic format to the NYSDEC by National Grid's QEP in accordance with the requirements of Table 7 and summarized in the PRR.

Table 7: Schedule of Interim Monitoring/Inspection Reports

All reporting will be prepared and submitted to the NYSDEC by National Grid's QEP.

Task/Report	Reporting Frequency*
Inspection Report	Annually**
Periodic Review Report	Annually
Groundwater Monitoring Report	Semi-Annually

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

**As the frequency of the Inspection Report and the Periodic Review Report are both annual, the results of the annual inspection will be included in the Periodic Review Report. A separate Inspection Report will not be prepared.

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Site condition(s) upon arrival;
- Description of non-routine activities performed.
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc.

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with NYSDEC requirements (link to the NYSDEC website: <http://www.dec.ny.gov/chemical/62440.html>).

7.2 Periodic Review Report

A PRR will be submitted for the Site by National Grid's QEP to the Department beginning 90 days after the end of the first year after approval of this SMP. The PRR will be prepared and submitted to the NYSDEC by National Grid and summarize activities subject to this SMP conducted on the Site and the Off-Site Property. After submittal of the initial PRR, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the Site or the Off-Site Property is subdivided into separate parcels with different ownership, a single PRR will be prepared that addresses the Site and the Off-Site Property by National Grid described in Appendix A - Environmental Easement (Site only). The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 90 days of the end of each certification period. Media sampling results will also be incorporated into the PRR. The report, to be prepared by National Grid, will include:

- Identification, assessment and certification of ECs and ICs required by the remedy for the Site.
- Results of the required annual inspections and after severe weather condition, if

applicable, inspections of the Site and the Off-Site Property conducted by National Grid's QEP.

- Applicable site management forms and other records generated for the Site/Off-Site Property by National Grid's QEP during the reporting period in electronic format, if not previously submitted.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater) to be prepared by National Grid's QEP, which include a listing of compounds analyzed, along with the applicable standards, with exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of analyses, copies of laboratory data sheets, and the required laboratory data deliverables for samples collected by National Grid's QEP during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQUIS™ database in accordance with the requirements found at this link: <http://www.dec.ny.gov/chemical/62440.html>.
- An evaluation of the Site and the Off-Site Property by National Grid's QEP, which includes the following:
 - The compliance of the remedy with the requirements of the ROD;
 - Any new conclusions or observations regarding contamination based on inspections of the Site and the Off-Site Property conducted by National Grid's QEP or data generated by the Monitoring and Sampling Plan for the media being monitored; and
 - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan.
 - The overall performance and effectiveness of the remedy.

The PRRs for the Site and the Off-Site Property will be submitted by National Grid, in hard-copy format, to the NYSDEC Central Office and Regional Office in which the Site/Off-Site Property is located, and in electronic format to the NYSDEC Central Office, the NYSDEC Regional Office and the NYSDOH Bureau of Environmental Exposure Investigation.

7.2.1 Certification of Institutional and Engineering Controls

National Grid's New York State Professional Engineer or QEP will prepare, and include in the PRR, the following certification as per the requirements of NYSDEC DER-10:

For the Site:

"For each institutional or engineering control identified for the Site, I certify that all of the following statements are true:

- *The inspection of the Site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this Site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any SMP for this control;*
- *Access to the Site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the Site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the Site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, Marek Ostrowski, of Brown and Caldwell located at 500 North Franklin Turnpike, Ramsey, New Jersey, am certifying as the

Owner's/Remedial Party's/Respondent's Designated Site Representative have been authorized and designated by the owner Remedial Party to sign this certification for the Site."

For the Off-Site Property:

"For each engineering control identified for the Off-Site Property, I certify that all of the following statements are true:

- The inspection of the Off-Site Property to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- The engineering control(s) employed at this Off-Site Property is unchanged from the date the control was put in place, or last approved by the National Grid;*
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- Nothing has occurred that would constitute a violation or failure to comply with any SMP for this control;*
- Access to the Off-Site Property will continue to be provided to National Grid to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- If a financial assurance mechanism is required under the oversight document for the Off-Site Property, the mechanism remains valid and sufficient for the intended purpose under the document;*
- Use of the Off-Site Property is compliant with this SMP;*
- The engineering control systems are performing as designed and are effective;*
- To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Off-Site remedial program and generally accepted engineering practices; and*
- The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law. I, _____, of Company [Name and address], am certifying as the Owner’s/Remedial Party’s/Respondent’s Designated Site Representative have been authorized and designated by the owner Remedial Party to sign this certification for the Site.”

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed on the Site or the Off-Site Property, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC by National Grid’s QEP for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

SECTION 8

REFERENCES

6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

Brown and Caldwell Associates, February 2012. *Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182.*

NYSDEC, 2011. DER-31 / Green Remediation. August 11, 2010 (January 20, 2011 Addendum).

NYSDEC, 2010. DER-10 / *Technical Guidance for Site Investigation and Remediation*. Office of Remediation and Materials Management. May 3, 2010.

NYSDEC, 1998. *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1*. June 1998 (April 2000 addendum).

TetraTech EC, Inc., December 2009. *Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York.*

Vanessa, Hangen, Brustlin, March 2002. *Preliminary Site Assessment Report, Order on Consent D1-0001-99-05, NYSDEC Site No. 1-52-182, Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York.*

TABLES

TABLE 2
WATER ELEVATIONS AND NAPL MONITORING DATA
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Location ID	Top of Casing Elevation (ft., NAVD)	Depth to Water (ft., BTOC)	9/28/2020		
			Water Elevation (ft., NAVD)	Depth to NAPL (ft., BTOC)	Total Depth of Well (ft., BTOC)
MW-1	11.47	5.91	5.56	NI	15.25
MW-3	5.56	1.72	3.84	NI	10.10
MW-4S	7.97	4.84	3.13	NI	12.28
MW-4D	7.79	4.57	3.22	NI	26.70
MW-7S	8.45	4.40	4.05	NI	12.45
MW-7D	8.31	4.25	4.06	NI	28.17
MW-8S	5.01	0.76	4.25	NI	9.90
MW-8D	4.99	0.72	4.27	NI	25.24
MW-10S	5.77	1.14	4.63	NI	15.51
MW-10D	5.73	1.17	4.56	NI	25.35
MW-11S	5.02	0.90	4.12	NI	13.80
MW-11D	5.14	1.02	4.12	NI	23.70
MW-12S	4.99	1.52	3.47	NI	13.90
MW-12D	4.92	1.41	3.51	NI	23.95
MW-13S	4.98	1.45	3.53	NI	13.32
MW-13D	4.96	1.43	3.53	NI	23.95
MW-14S	4.86	0.95	3.91	NI	12.63
MW-14D	4.82	1.00	3.82	NI	22.09
SG-1	5.38	3.81	1.57	--	NA
SG-2	5.25	NM	--	--	NA

Notes:

NAVD - North American Vertical Datum 1988

ft. - Feet

BGS - Below Ground Surface

BTOC - Below Top of Casing

NA - Not Applicable

NI - NAPL not Indicated by Oil/Water Interface Probe

NM - Not measured

MW - monitoring well

SG - staff gauge

TABLE 3
HISTORICAL AND REMEDIAL DOCUMENTS
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Description	Report Date	Author
Preliminary Site Assessment Work Plan, Patchogue	May 2001	VHB/Vanasse Hangen Brustin, Inc.
Preliminary Site Assessment Report, Order on Consent D1-0001-99-05, NYDEC Site No. 1-52-182, Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York	March 2002	VHB/Vanasse Hangen Brustin, Inc.
Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York	December 2009	Tetra Tech EC, Inc.
Work Plan for Pre-Design Investigation Activities, Patchogue Former MGP Site	May 10, 2010	BC Associates
Supplemental Pre-Design Investigation Work Plan, Patchogue Former MGP Site, Suffolk County, New York, Site No. 1-52-182	September 14, 2010	BC Associates
Focused Feasibility Study, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk	May 2011	BC Associates
First Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site - Site ID No. 1-52-182, Patchogue, New York	May 2011	BC Associates
Second Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	July 2011	BC Associates
Third Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	October 2011	BC Associates
Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182	February 8, 2012	BC Associates
Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	February 2012	BC Associates
Fourth Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	February 2012	BC Associates
First Quarter 2012 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	May 2012	BC Associates
Second Quarter 2012 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	September 2012	BC Associates
Remedial Design Report (50-75% Submission), Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	December 2012	BC Associates
Construction Completion Report, Utility Corridor Work Plan Implementation, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	December 2012	BC Associates
Second Half 2012 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	April 2013	BC Associates
Off-Site Investigation Work Plan, Patchogue Former MGP Site	August 8, 2013	BC Associates
First Half 2013 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	October 2013	BC Associates
Second Half 2013 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2013	BC Associates
Summary of Intrusive Activities - Utility Pole Installation, Patchogue Former Manufactured Gas Plant Site	November 7, 2014	BC Associates
First Half 2014 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	November 2014	BC Associates
Second Half 2014 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2015	BC Associates
First Half 2015 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	October 2015	BC Associates
Second Half 2015 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2016	BC Associates

TABLE 3
HISTORICAL AND REMEDIAL DOCUMENTS
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Description	Report Date	Author
Off-Site Investigation Work Plan Addendum, Patchogue Former MGP Site	February 1, 2016	BC Associates
Off-Site Investigation Summary Letter Report, Patchogue Former MGP Site	April 25, 2016	BC Associates
First Half 2016 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	September 2016	BC Associates
Second Half 2016 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2017	BC Associates
Summary of Intrusive Activities - Fence Demolition and New Fence Installation, Patchogue Former Manufactured Gas Plant Site	June 28, 2017	BC Associates
First Half 2017 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	August 2017	BC Associates
Second Half 2017 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2018	BC Associates
Remedial Design Report (90-95% Submission), Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	April 2018	BC Associates
First Half 2018 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	September 2018	BC Associates
Summary of Intrusive Activities, On-Site Gas Manifold and Associated Piping Removal, Patchogue Former Manufactured Gas Plant Site	November 28, 2018	BC Associates
Second Half 2018 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2019	BC Associates
Remedial Design Report (100% Submission), Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	May 2019	BC Associates
First Quarter 2020 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	June 2020	BC Associates
Second Quarter 2020 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	October 2020	BC Associates
Third Quarter 2020 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	December 2020	BC Associates
Fourth Quarter 2020 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2021	BC Associates
First Quarter 2021 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	May 2021	BC Associates
Second Quarter 2021 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	August 2021	BC Associates
Third Quarter 2021 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	December 2021	BC Associates
Fourth Quarter 2021 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2022	BC Associates
First Half 2022 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	September 2022	BC Associates
Final Engineering Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	January 2023	BC Associates

TABLE 4A
REMAINING ON-SITE SOIL SAMPLE EXCEEDANCES OF NYSPART375 - RESTRICTED RESIDENTIAL (RR)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375RR	Units	PASB-03	PASB-08	PASB-23	PASB-31	PASB-33	SB-112	SB-113	SB-114
			4-6	6-10	3-5	2-4	1-3 ⁽¹⁾	1-3 ⁽¹⁾	1-3 ⁽¹⁾	1-3 ⁽¹⁾
			PSA	PSA	RI	RI	RI	SPDI	SPDI	SPDI
Volatile Organic Compounds (VOCs)										
BTEX										
Benzene	2.9	mg/kg	0.013 B	0.005 U	0.0043 U	0.0043 U	0.0043 U	0.0006 U	0.0006 J	0.0009 J
Toluene	100	mg/kg	0.014	0.005 U	0.0048 U	0.0048 U	0.0052 U	0.001 U	0.001 J	0.001 J
Ethylbenzene	30	mg/kg	0.005 U	0.005 U	0.0053 U	0.014 J	0.0048 U	0.001 U	0.001 J	0.002 J
Xylenes, Total	100	mg/kg	0.002 J	0.015 U	NA	NA	NA	0.001 U	0.001 U	0.006
Total BTEX	NE	mg/kg	0.029	ND	ND	0.014 J	ND	ND	0.0026	0.0099
Polycyclic Aromatic Hydrocarbons (PAHs)										
Acenaphthene	100	mg/kg	0.33 U	0.33 U	0.17 J	9.1 D	0.24 J	0.038 U	0.17 J	0.11 J
Acenaphthylene	100	mg/kg	0.33 U	0.33 U	0.58	1.1	2.6	1.2	3.2	0.84
Anthracene	100	mg/kg	0.17 J	0.33 U	0.61	8 D	39 D	1	2.2	0.89
Benzo(a)anthracene	1	mg/kg	0.33 U	0.33 U	2	<u>6.1</u>	<u>8.2</u>	<u>3.1</u>	<u>12</u>	2
Benzo(a)pyrene	1	mg/kg	<u>1.4</u>	1	0.95	<u>5.4</u>	<u>8</u>	<u>3.4</u>	<u>8</u>	<u>2.1</u>
Benzo(b)fluoranthene	1	mg/kg	0.33 U	0.33 U	<u>2.1</u>	<u>4.7</u>	<u>9.1</u>	<u>3.9</u>	<u>14</u>	<u>3.4</u>
Benzo(g,h,i)perylene	100	mg/kg	1.1	0.55	1.4	2.5	6.5	2.7	9.1	2.1
Benzo(k)fluoranthene	1	mg/kg	0.69	0.25 J	0.95	<u>1.3</u>	<u>3.5</u>	<u>1.5</u>	<u>4.4</u>	<u>1.5</u>
Chrysene	1	mg/kg	0.33 U	0.33 U	<u>2.1</u>	<u>5.1</u>	<u>17 D</u>	<u>3.7</u>	<u>15</u>	<u>2.6</u>
Dibenzo(a,h)anthracene	0.33	mg/kg	<u>0.71</u>	<u>0.4</u>	<u>0.34 J</u>	<u>0.57 J</u>	<u>1.2 J</u>	<u>0.65</u>	<u>1.6</u>	<u>0.52</u>
Fluoranthene	100	mg/kg	1.7	0.94	3	11 D	14	2.5	14	2
Fluorene	100	mg/kg	0.71	0.34	0.27 J	6.2	1.4 J	0.16 J	0.62 J	0.16 J
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	<u>0.6</u>	<u>1</u>	<u>0.88</u>	<u>1.6</u>	<u>4.2</u>	<u>2.5</u>	<u>8.6</u>	<u>2</u>
Naphthalene	100	mg/kg	1.6	0.33 U	0.19 J	4.5	0.82 J	0.087 J	1.5	0.34
Phenanthrene	100	mg/kg	1.6	0.74	1.6	23 D	11	0.52	3	0.6
Pyrene	100	mg/kg	0.2 J	0.33 U	4.6 D	19 D	18 D	4.1	19	3.7
Total PAHs	NE	mg/kg	10	5.2	22	109	145	31	116	25
Inorganic Constituents										
Cyanide, Total	27	mg/kg	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA

Notes:

1) Analytical results from PASB-33, SB-112, SB-113, and SB-114 are representative of the 2-3 ft bgs interval. During remedial activities, the existing soil was excavated to 2 feet bgs, disposed off-site, and excavation was backfilled with 2 feet of clean fill.

NYSPART375RR - NYS Part 375 Restricted Residential (RR) Soil Cleanup Objective.

PSA - Preliminary Site Assessment.

RI - Remedial Investigation samples

SPDI - Supplemental Pre-Design Investigation samples

Values presented with an underline exceed the NYSPART375RR

U - The analyte was analyzed for, but was not detected. Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.

J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.

B - Analyte was found in the sample as well as the associated blank.

D - Diluted

ND - Not detected.

NA - Not analyzed.

TABLE 4B
REMAINING OFF-SITE PROPERTY SOIL SAMPLE EXCEEDANCES OF NYSPART375 RESTRICTED RESIDENTIAL (RR)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375RR	Units	PASB-37 5-7 RI
Volatile Organic Compounds (VOCs)			
BTEX			
Benzene	2.9	mg/kg	0.11 U
Toluene	100	mg/kg	0.0054 U
Ethylbenzene	30	mg/kg	0.005 UJ
Xylenes, Total	100	mg/kg	NA
Total BTEX	NE	mg/kg	ND
Polycyclic Aromatic Hydrocarbons (PAHs)			
Acenaphthene	100	mg/kg	7.2
Acenaphthylene	100	mg/kg	4.7
Anthracene	100	mg/kg	14
Benzo(a)anthracene	1	mg/kg	<u>22</u>
Benzo(a)pyrene	1	mg/kg	<u>17</u>
Benzo(b)fluoranthene	1	mg/kg	<u>15</u>
Benzo(g,h,i)perylene	100	mg/kg	9
Benzo(k)fluoranthene	1	mg/kg	<u>5.2</u>
Chrysene	1	mg/kg	0.32 U
Dibenzo(a,h)anthracene	0.33	mg/kg	<u>2.3</u> J
Fluoranthene	100	mg/kg	43 D
Fluorene	100	mg/kg	11
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	<u>7.5</u>
Naphthalene	100	mg/kg	3.9 J
Phenanthrene	100	mg/kg	57 D
Pyrene	100	mg/kg	56 D
Total PAHs	NE	mg/kg	275
Inorganic Constituents			
Cyanide, Total	27	mg/kg	NA

Notes:

NYSPART375RR - NYS Part 375 Restricted Residential (RR) Soil Cleanup Objective.

PSA - Preliminary Site Assessment.

RI - Remedial Investigation samples

SPDI - Supplemental Pre-Design Investigation samples

Values presented with an underline exceed the NYSPART375RR

U - The analyte was analyzed for, but was not detected. Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.

J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.

B - Analyte was found in the sample as well as the associated blank.

D - Diluted

ND - Not detected.

NA - Not analyzed.

NE- Not established.

TABLE 5
POST REMEDIATION GROUNDWATER SAMPLING REQUIREMENTS AND SCHEDULE
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Sample Location(1)	Analytical Parameters		Schedule ⁽¹⁾
	BTEX compounds (USEPA SW-846 Method 8260B)	PAHs (USEPA SW-846 Method 8270C)	
MW-1	X	X	Quarterly
MW-3	X	X	Quarterly
MW-4S	X	X	Quarterly
MW-4D	X	X	Quarterly
MW-7S	X	X	Quarterly
MW-7D	X	X	Quarterly
MW-8S	X	X	Quarterly
MW-8D	X	X	Quarterly
MW-10S	X	X	Quarterly
MW-10D	X	X	Quarterly
MW-11S	X	X	Quarterly
MW-11D	X	X	Quarterly
MW-12S	X	X	Quarterly
MW-12D	X	X	Quarterly
MW-13S	X	X	Quarterly
MW-13D	X	X	Quarterly
MW-14S	X	X	Quarterly
MW-14D	X	X	Quarterly

Notes:

(1) - Following two years of post-remediation groundwater monitoring, the sampling frequency will be reduced to semi-annual basis from Year 3 through 5. After Year 2, MW-12D and MW-13D will not be included in the sampling events. The sampling

TABLE 6
MONITORING WELL CONSTRUCTION DETAILS
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Monitoring Well ID	Well Location	Coordinates (Easting/Northing)	Well Diameter (inches)	Elevation (above mean sea level)			Screen Bottom
				Casing	Surface	Screen Top	
MW-1	Upgradient	Easting: 1255132.538 ft Northing: 219674.03 ft	2	11.23	7.53	0.53	-4.47
MW-3	Downgradient	Easting: 1255328.742 ft Northing: 219200.312 ft	2	5.42	5.56	0.42	-4.58
MW-4S	Downgradient	Easting: 1255290.459 ft Northing: 219131.475 ft	2	7.97	4.23	-0.77	-5.77
MW-4D	Downgradient	Easting: 1255291.583 ft Northing: 219134.531 ft	2	7.79	4.36	-15.64	-20.64
MW-7S	On-Site	Easting: 1255153.2993 ft Northing: 219212.046 ft	2	8.45	5.37	1.37	-3.63
MW-7D	On-Site	Easting: 1255151.943 ft Northing: 219210.1789 ft	2	8.31	5.20	-14.80	-19.80
MW-8S	Downgradient	Easting: 1255313.690 ft Northing: 219375.899 ft	2	5.08	5.05	1.05	-3.95
MW-8D	Downgradient	Easting: 1255314.267 ft Northing: 219376.872 ft	2	4.98	5.04	-14.96	-19.96
MW-10S	Upgradient	Easting: 1255206.931 ft Northing: 219407.759 ft	2	5.77	5.98	-0.02	-10.02
MW-10D	Upgradient	Easting: 1255202.865 ft Northing: 219407.394 ft	2	5.73	6.11	-9.89	-19.89
MW-11S	Sidewater	Easting: 1255282.476 ft Northing: 219312.947 ft	2	5.02	5.29	1.29	-8.71
MW-11D	Sidewater	Easting: 1255282.692 ft Northing: 219309.513 ft	2	5.14	5.31	-8.69	-18.69
MW-12S	Downgradient	Easting: 1255370.506 ft Northing: 219237.739 ft	2	4.99	5.43	1.43	-8.57
MW-12D	Downgradient	Easting: 1255368.082 ft Northing: 219234.105 ft	2	4.92	5.43	-8.57	-18.57
MW-13S	Downgradient	Easting: 1255314.091 ft Northing: 219209.600 ft	2	4.98	5.37	1.37	-8.63
MW-13D	Downgradient	Easting: 1255315.719 ft Northing: 219207.093 ft	2	4.96	5.37	-8.63	-18.63
MW-14S	Downgradient	Easting: 1255224.994 ft Northing: 219200.126 ft	2	4.86	5.19	2.19	-7.81
MW-14D	Downgradient	Easting: 1255220.807 ft Northing: 219201.308 ft	2	4.82	5.16	-7.84	-17.84

TABLE 8
DECISION TREE FOR INTRUSIVE ACTIVITIES ON-SITE AND OFF-SITE
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

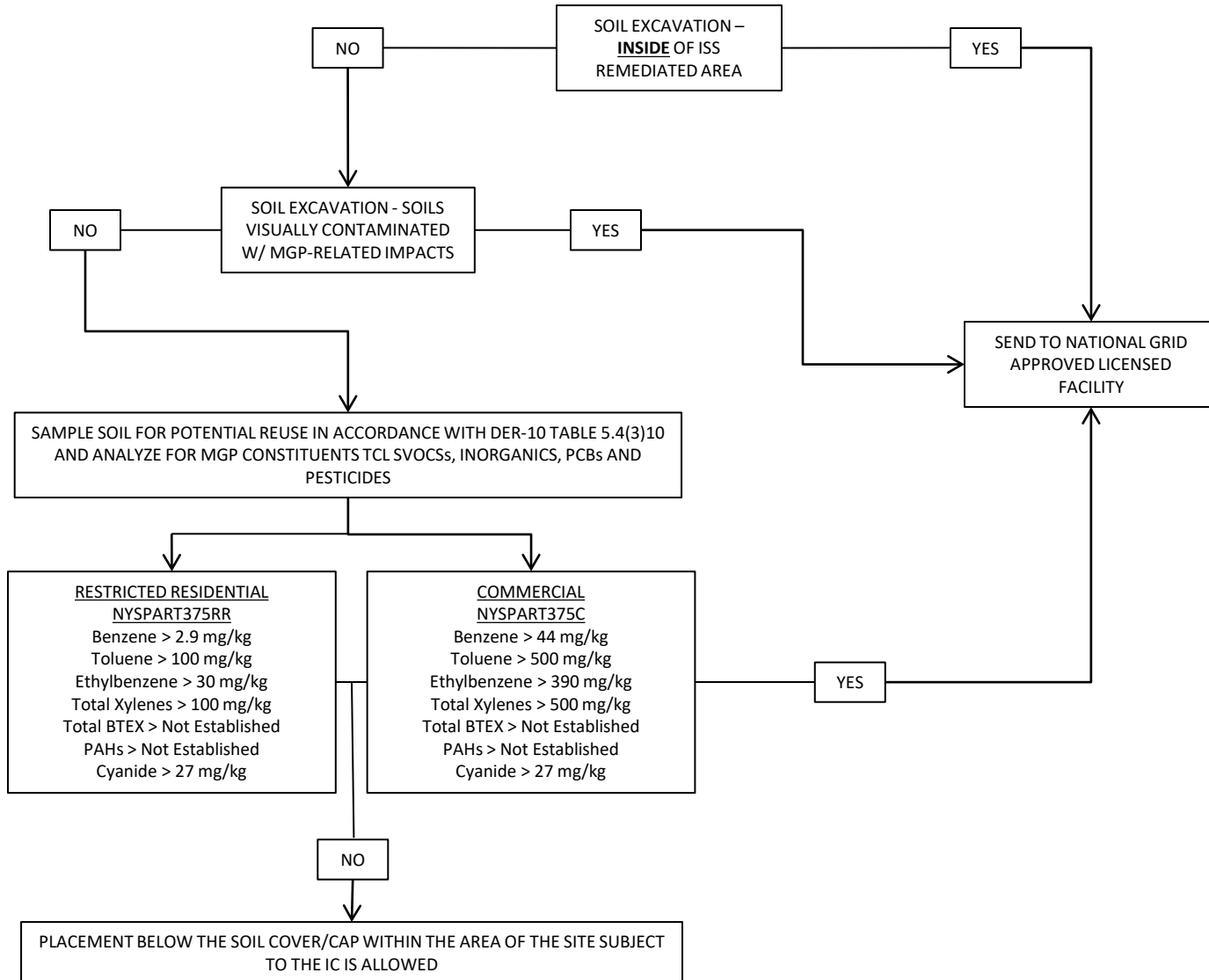


TABLE 9
MATRIX OF RESPONSIBILITY BY PROPERTY OWNER, NATIONAL GRID, AND GOVERNING AGENCY
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Task	NYSDEC	National Grid	Property Owner	RESPONSIBILITY			
				NYSDEC	National Grid (Remedial Party)	Present Site Owner and Future Owner of the Site (234 W. Main Street)	Off-Site Property Owner (212 W. Main Street)
Declaration of Covenants and Restrictions (DCR)		✓	✓	If access is not granted to National Grid by the property owner, NYSDEC to intervene, if necessary.	A DCR has been executed between the Off-Site Property Owner and National Grid for SMP implementation including maintaining engineering controls, following restrictions and institutional controls, and inspection and groundwater monitoring activities, or as otherwise required. Reference to the SMP is included in the text of the DCR. National Grid will request NYSDEC intervention on their behalf, if necessary.		A DCR has been executed between the Property Owner and National Grid for SMP implementation including maintaining engineering controls, following restrictions and institutional controls, and inspection and groundwater monitoring activities, or as otherwise required. Reference to the SMP is included in the text of the DCR. National Grid will request NYSDEC intervention on their behalf, if necessary.
Annual Report	✓	✓		Review and Comment as, necessary	Report will be completed by National Grid and submitted to NYSDEC. Report will include results of groundwater monitoring.	Grant access to the property for SMP implementation.	Grant access to the property for SMP implementation.
Community Air Monitoring Plan (CAMP)	✓	✓	✓	Review and Comment.	National Grid's environmental professional consultants will prepare a Site-specific CAMP and implement procedures during intrusive work in areas where MGP-related impacts may be encountered.	Property Owner's contractors and consultants will abide by direction given by National Grid's environmental consultant based on Community Air Monitoring results.	Property Owner's contractors and consultants will abide by direction given by National Grid's environmental consultant based on Community Air Monitoring results.
Corrective Measures Work Plan	✓	✓		Review, Comment, and Approve.	Prepare a Corrective Measures Work Plan and update when required.		
O&M of ECs - Cover System, Perimeter Fence		✓	✓		Inspect ECs during annual inspection and when required by NYSDEC. Notify NYSDEC of known damage.	Maintenance and repair of cover system and fence. Notify National Grid of damage.	Maintenance and repair of cover system and fence. Notify National Grid of damage.
Observed Damage or Defect to the ECs	✓	✓	✓	Review, Comment, and Approve.	National Grid's contracted qualified environmental professional conducts an inspection within 5 days of notification. National Grid provides NYSDEC with follow-up status reports for ongoing responsive action within 45 days.	Once identified, notice to National Grid and NYSDEC within 48 hours identifying damage and mitigation actions taken.	Once identified, notice to National Grid and NYSDEC within 48 hours identifying damage and mitigation actions taken.
Emergency Response due to EC Failure caused by Natural Disaster	✓	✓	✓	Review, Comment, and Approve, as necessary.	National Grid's contracted qualified environmental professional conducts an inspection within 5 days of event. Written confirmation to NYSDEC within 7 days of event that summarizes event and actions taken. National Grid provides NYSDEC with follow-up status reports for ongoing responsive action within 45 days.	Verbal notice to National Grid and NYSDEC as soon as possible but at least by noon the following day.	Verbal notice to National Grid and NYSDEC as soon as possible but at least by noon the following day.
Field Activity not Pursuant to the EWP	✓	✓	✓	Review and Comment.	Review and Comment.	Provide 45-day advance notice to National Grid and NYSDEC.	Provide 45-day advance notice to National Grid and NYSDEC.
Limited Intrusive Work (Small Scale)* performed under the Excavation Work Plan (EWP)	✓	✓	✓	Review and Comment.	National Grid to review and determine if oversight is required. Following development, National Grid to update SMP and submit to NYSDEC.	Property Owner has to provide at a minimum 45-day notice to National Grid and NYSDEC of any proposed ground-intrusive activity to be conducted. All ground intrusive activities are required to follow the SMP.	Property Owner has to provide at a minimum 45-day notice to National Grid and NYSDEC of any proposed ground-intrusive activity to be conducted. All ground intrusive activities are required to follow the SMP.
Field Sampling Plan (FSP)	✓	✓		Review and Comment.	National Grid's environmental professional consultants will follow a Site-specific NYSDEC-approved FSP procedures.		
Future Property Development (Large Scale)*	✓	✓	✓	Review and Comment, as necessary.	National Grid to review and determine if oversight is required upon notification by Property Owner. If new building, decision on vapor intrusion sampling will be evaluated. Following development, National Grid to update SMP and submit to NYSDEC.	Property Owner has to provide at a minimum 60-days notice to National Grid and NYSDEC and 45-days notice prior to work starting. Property Owner has to provide at a minimum 18-months notice to National Grid and NYSDEC of property redevelopment or demolition of structures. All ground intrusive activities have to follow the SMP.	Property Owner has to provide at a minimum 60-days notice to National Grid and NYSDEC and 45-days notice prior to work starting. Property Owner has to provide at a minimum 18-months notice to National Grid and NYSDEC of property redevelopment or demolition of structures. All ground intrusive activities have to follow the SMP.
Future Site Subdivision			✓		National Grid notifies NYSDEC.	Property owner notifies National Grid of the subdivision.	Property owner notifies National Grid of the subdivision.
Groundwater Use and Fluids Management*			✓			Never, removed groundwater shall be managed pursuant to the SMP	Never, removed groundwater shall be managed pursuant to the SMP
HASP		✓	✓		National Grid will aid in the development of task-specific HASP.	Develop a Site-specific HASP for any subsurface work deeper than 24-inches below ground surface or top of water table whichever is shallower.	Develop a Site-specific HASP for any subsurface work deeper than 24-inches below ground surface or top of water table whichever is shallower.
Inspections		✓	✓		National Grid will complete inspections once per year and after severe weather that may affect ECs and ICs. A Site Management Form will be completed and provided to NYSDEC.	Property Owner will provide access.	Property Owner will provide access.

TABLE 9
MATRIX OF RESPONSIBILITY BY PROPERTY OWNER, NATIONAL GRID, AND GOVERNING AGENCY
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Task	NYSDEC	National Grid	Property Owner	RESPONSIBILITY			
				NYSDEC	National Grid (Remedial Party)	Present Site Owner and Future Owner of the Site (234 W. Main Street)	Off-Site Property Owner (212 W. Main Street)
Environmental Easement (EE)	✓		✓	The EE will be executed between the Property Owner and the NYSDEC.	National Grid will prepare the EE.	The EE will be executed between the Owner of the property and the NYSDEC.	The EE is not applicable to the off-site property
Metes and Bounds Survey		✓	✓		National Grid will perform a Metes and Bounds (or similar) Survey to include in the SMP and Environmental Easement.	Property Owner will provide access.	Property Owner will provide access.
Monitoring Well Damage/Maintenance or Well Decommissioning	✓	✓	✓	Review, Comment, and Approve.	National Grid will be responsible for any maintenance related to the groundwater monitoring well network. National Grid will notify NYSDEC prior to properly repairing, replacing, or decommissioning wells.	Property Owner will provide access.	Property Owner will provide access.
Operation and Maintenance (O&M) Plan					O&M plan is not required.	O&M plan is not required.	O&M plan is not required.
Post Remediation Media Monitoring and Sampling	✓	✓	✓	Review, Comment, and Approve.	Media monitoring and sampling will be completed by National Grid as detailed in the SMP. Modification requires NYSDEC approval.	Property Owner will provide access.	Property Owner will provide access.
Property Use Change (currently Restricted Residential, Industrial, Commercial)	✓	✓	✓	Review and Comment, as necessary.	National Grid to review and confer with NYSDEC if SMP revision and/or additional ICs are required. Following use change, National Grid to update SMP and submit to NYSDEC, if required.	Provide at a minimum 60 days notice to National Grid and NYSDEC.	Provide at a minimum 60 days notice to National Grid and NYSDEC.
Property Ownership Change		✓	✓		National Grid will notify DEC of any event and associated changes within 15 days of notification by the Property Owner. National Grid will submit update to NYSDEC.	Provide at a minimum 60 days notice to National Grid and NYSDEC. Confirmation of new Property Owner within 15 days of the property transfer.	Provide at a minimum 60 days notice to National Grid and NYSDEC. Confirmation of new Property Owner within 15 days of the property transfer.
Quality Assurance Project Plan (QAPP)	✓	✓		Review and Comment.	National Grid's environmental professional consultants will follow Site-specific NYSDEC-approved QAPP procedures.		
Security			✓			Property Owner is responsible for site security.	Property Owner is responsible for site security.
Site Management Plan (SMP)	✓	✓	✓	Review and Approve SMP and revisions. Append revisions to SMP.	Prepare the SMP and update when required.	Implement the SMP for any ground intrusive work.	Implement the SMP for any ground intrusive work.

Notes:
* - The property owner is required to comply with the SMP including all notifications to National Grid and provisions of the Excavation Work Plan. National Grid is only responsible for costs associated with MGP-related impacts.
Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the Site.

FIGURES

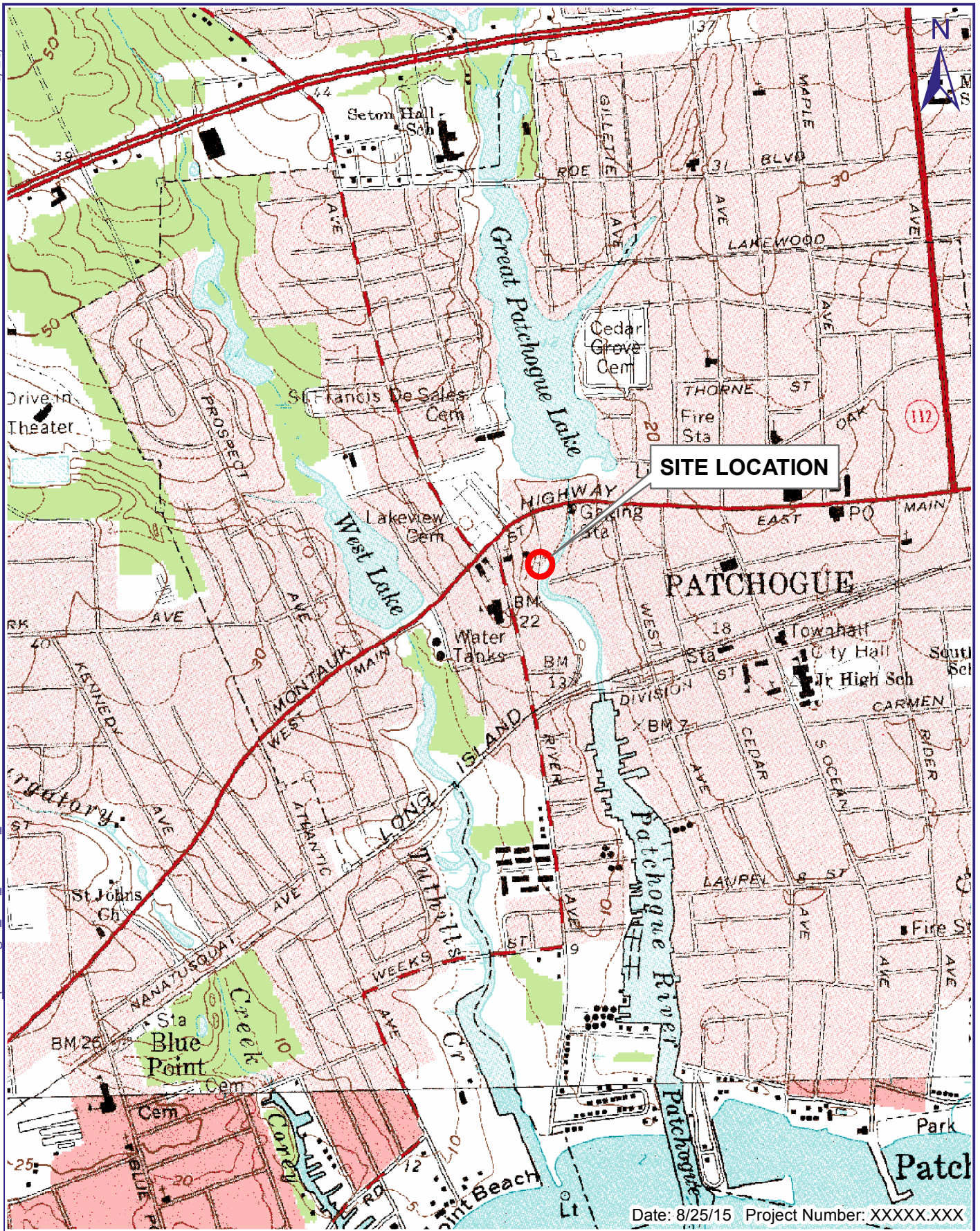


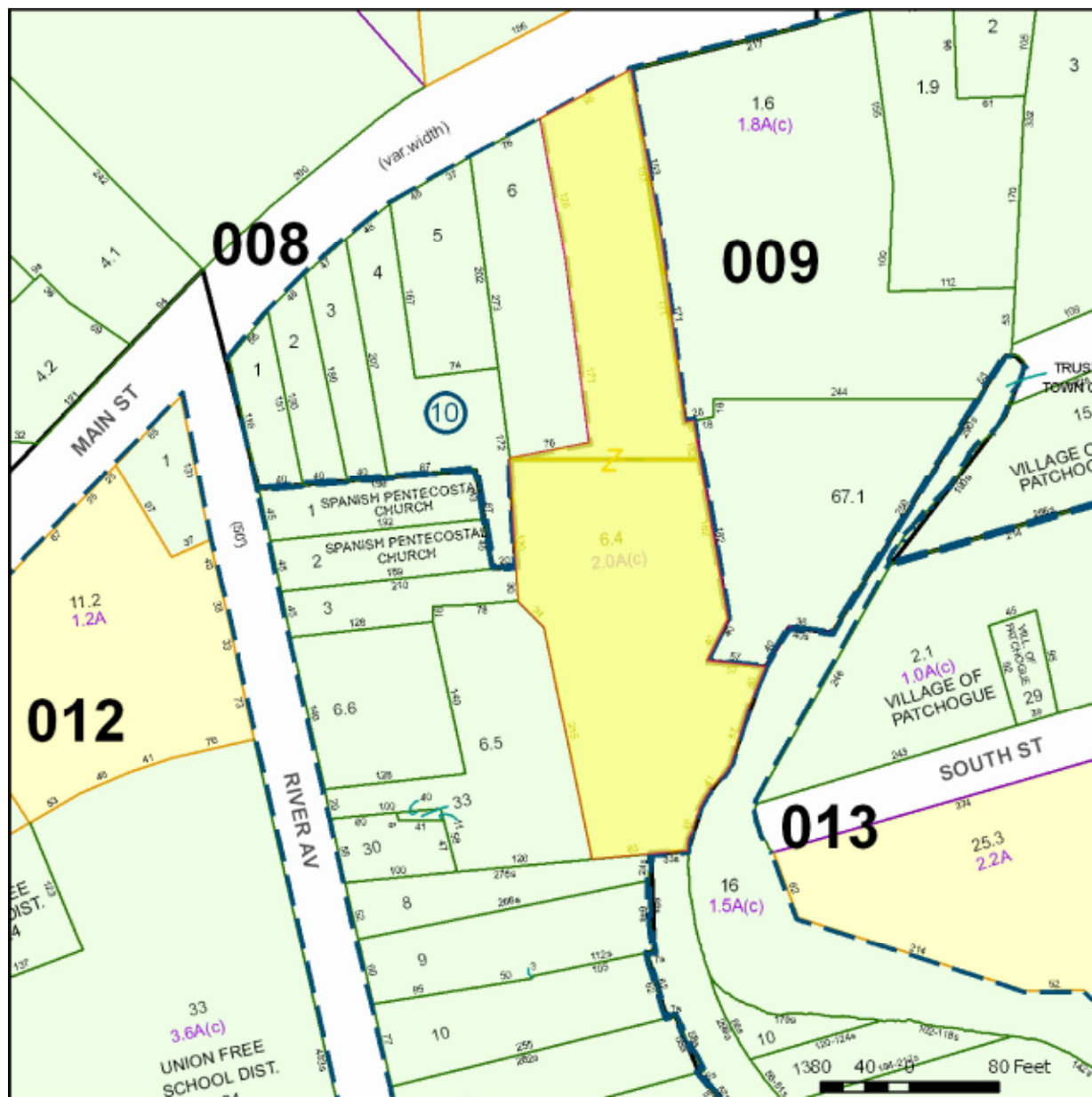
FIGURE 1
SITE LOCATION MAP
NATIONAL GRID - PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

COUNTY OF SUFFOLK



REAL PROPERTY TAX SERVICE AGENCY

DISTRICT 0204 - SECTION - 01200 - BLOCK - 0900 - LOT - 006004



Map



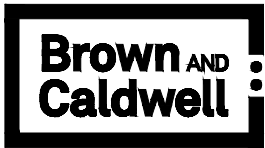
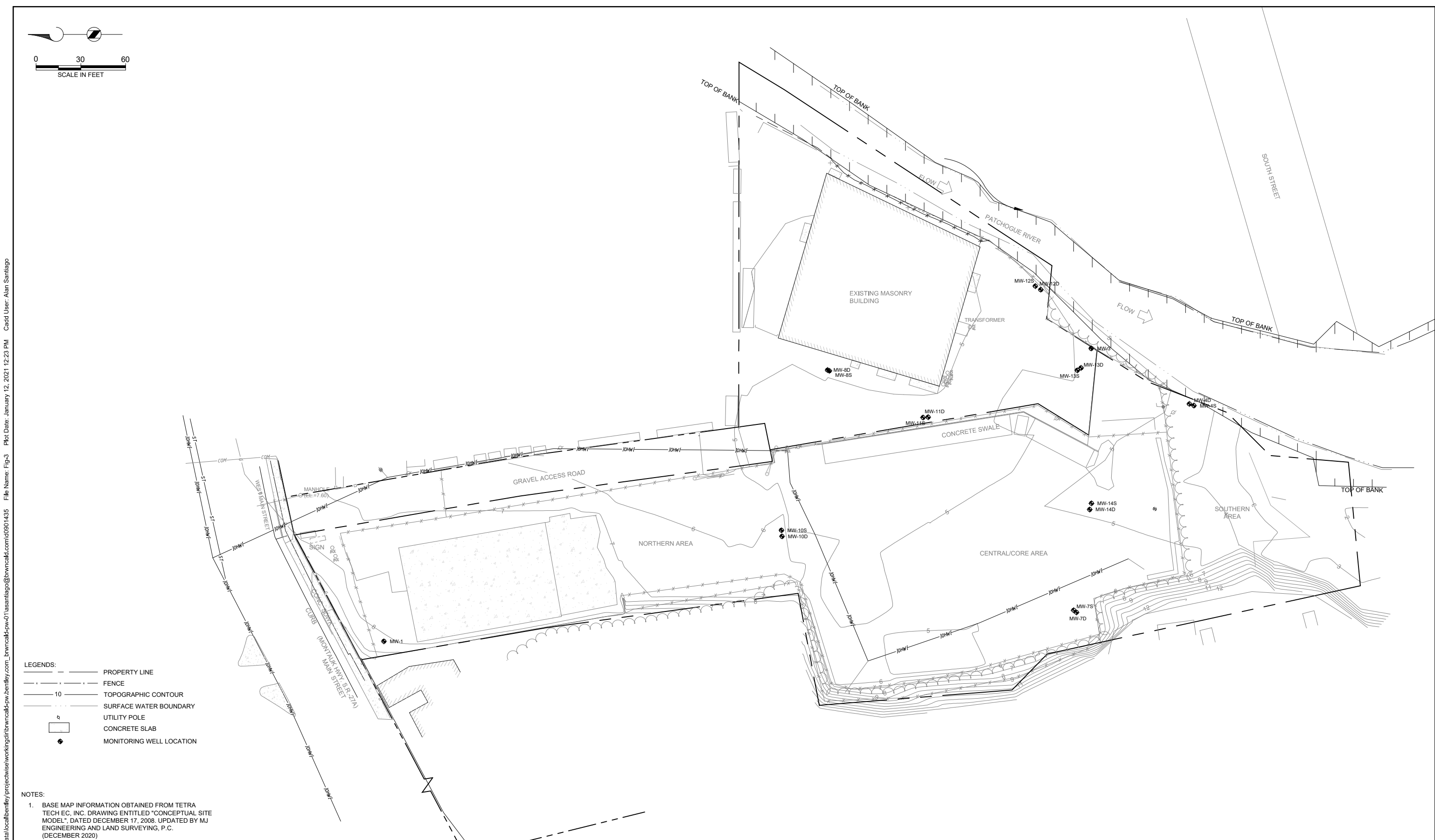
© County of Suffolk Copyright Notice: Maintenance, alteration, sale or distribution of any portion of the Suffolk County Tax Map is prohibited without written permission of the Real Property Tax Service Agency. Suffolk County Real Property does not in any manner guarantee the completeness or accuracy of the information contained on this page.

9/30/2015



FIGURE 2A
TAX MAP
NATIONAL GRID-PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

9/30/2015

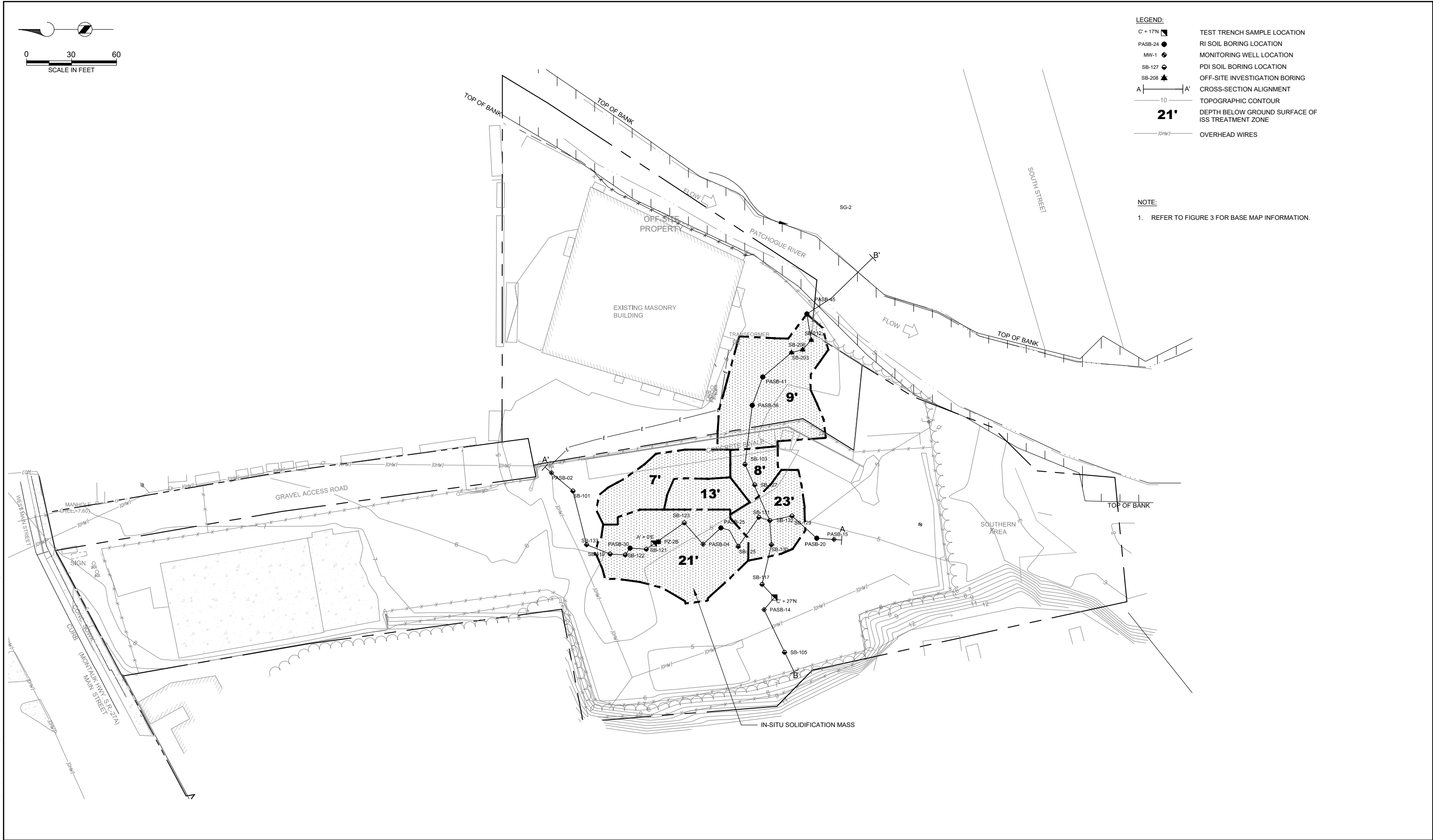


SCALE: 1" = 60'
153021
DATE: January 2021

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

SITE PLAN OF ON-SITE AND OFF-SITE PROPERTIES

Path: C:\users\asantiago\appdata\local\beniley\project\wise\workingdir\brwncal-pw-bentley.com_brwncal-pw-01\asantiago@brwncal.com\d001435 File Name: Fig-5A Plot Date: January 12, 2021 12:24 PM Cadd User: Alan Santiago



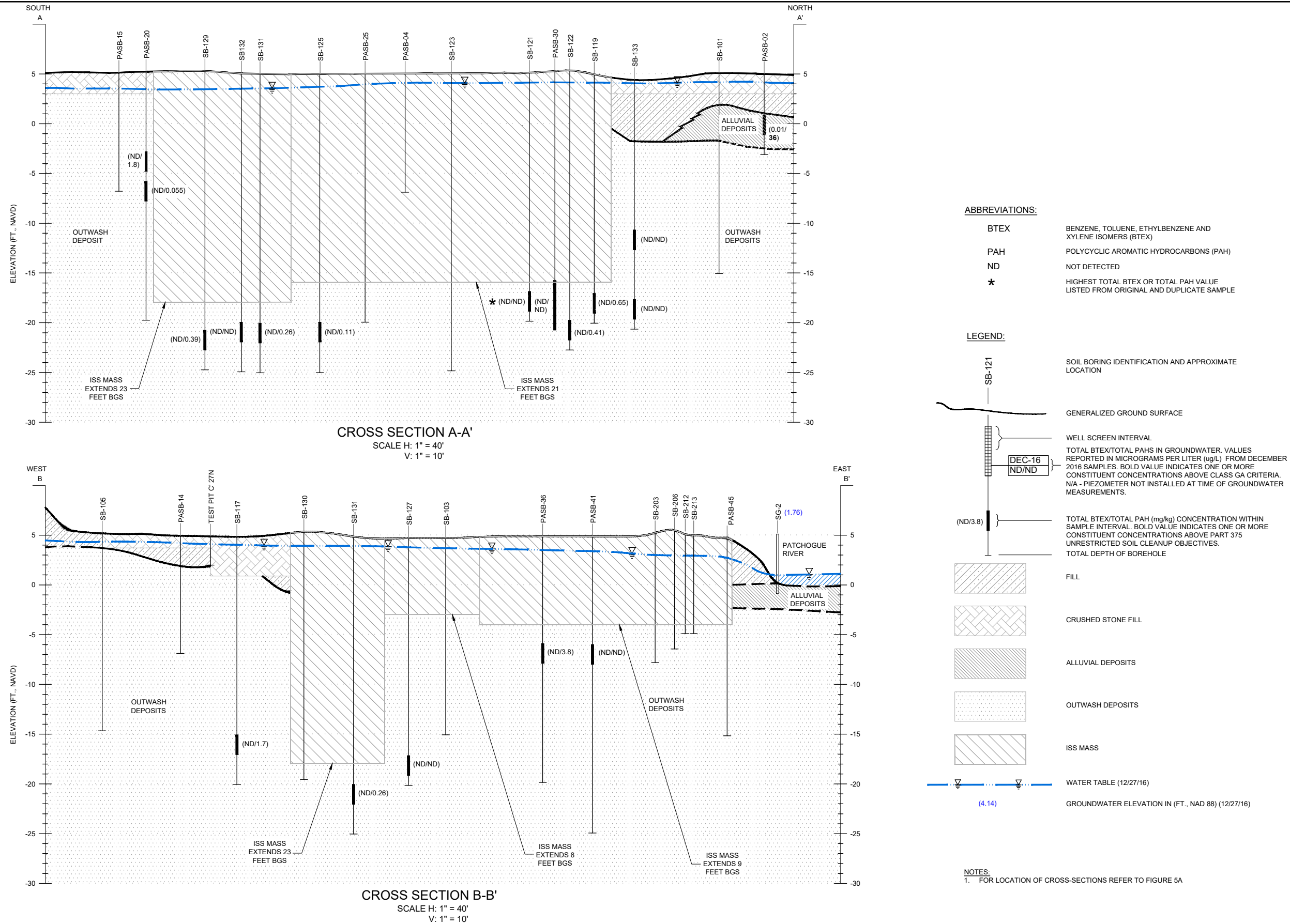
SCALE: AS NOTED
153021
DATE: January 2021

GEOLOGICAL CROSS-SECTION LOCATIONS

FIGURE

4A

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SCALE: AS NOTED

153021

DATE: January 2021

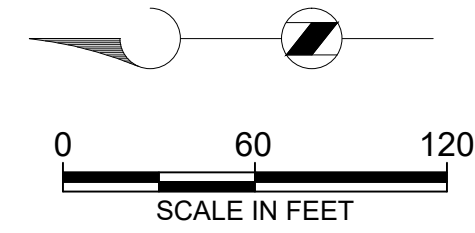
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

GEOLOGICAL CROSS-SECTIONS

FIGURE

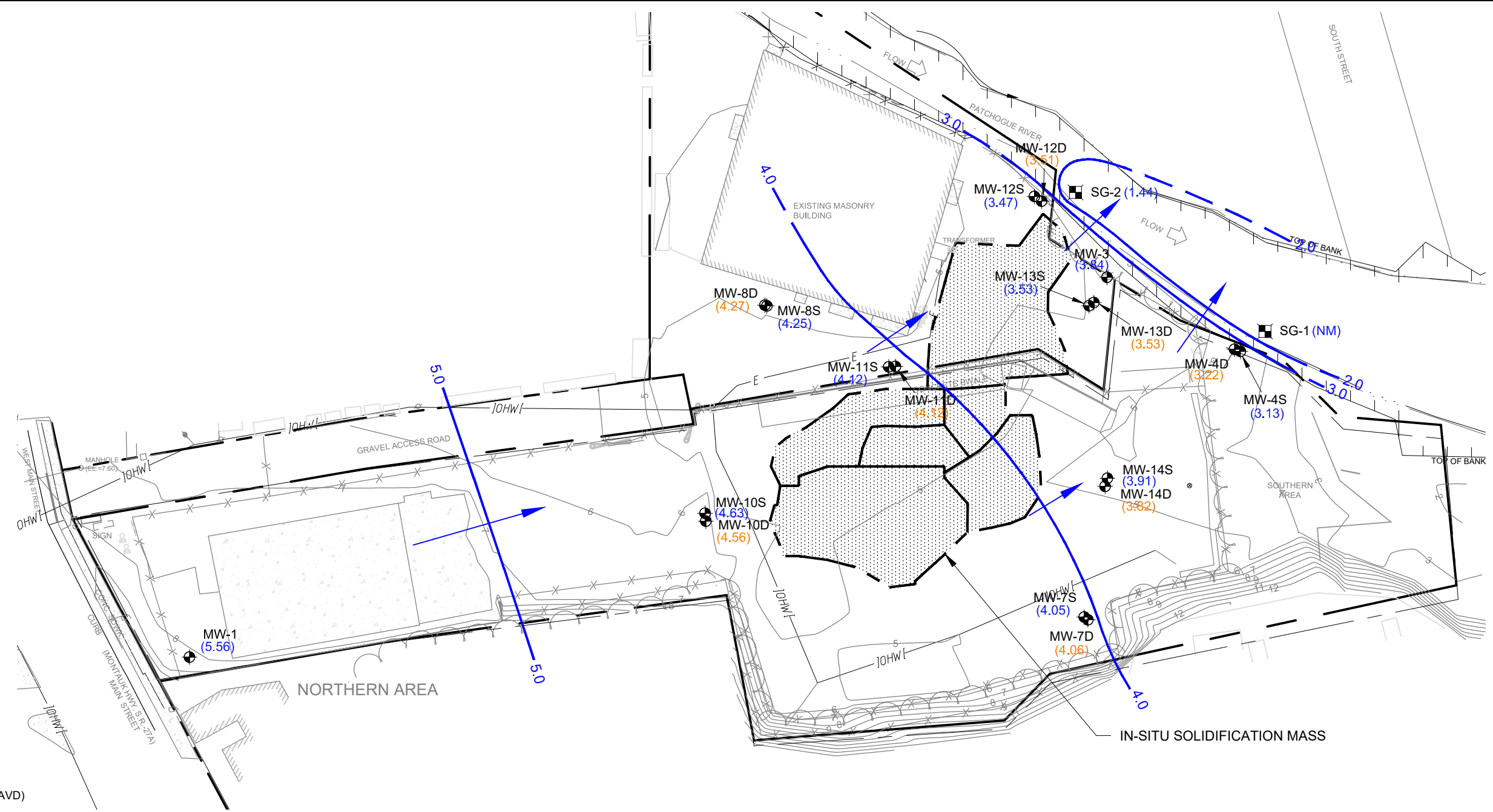
4B

Path: C:\users\lasantiago\appdata\local\bentley\projectwise\workingdir\brwncaid\pw.bentley.com_brwncaid-pw-01\lasantiago@brwncaid.com\d0901435 File Name: FIG-6-(GW_Contours_Sep-2020) Plot Date: January 12, 2021 12:25 PM Cadd User: Alan Santiago



- LEGEND:
- PROPERTY LINE
 - x x FENCE
 - 10 TOPOGRAPHIC CONTOUR
 - MONITORING WELL LOCATION
 - STAFF GAGE LOCATION
 - 4.0 WATER TABLE CONTOUR (FT., NAVD)
DASHED WHERE INFERRED
 - (4.30) GROUNDWATER ELEVATION (FT., NAVD) FROM
SHALLOW MONITORING WELL (SCREENED ACROSS OR
CLOSE TO WATER TABLE) OR RIVER LEVEL FROM
STAFF GAUGE (FT., NAVD).
 - (4.34) GROUNDWATER ELEVATION (FT., NAVD) FROM DEEP
MONITORING WELL (SCREENED BELOW WATER TABLE). VALUE
NOT USED FOR CONTOURING.
 - GENERALIZED DIRECTION OF GROUNDWATER FLOW

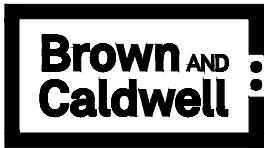
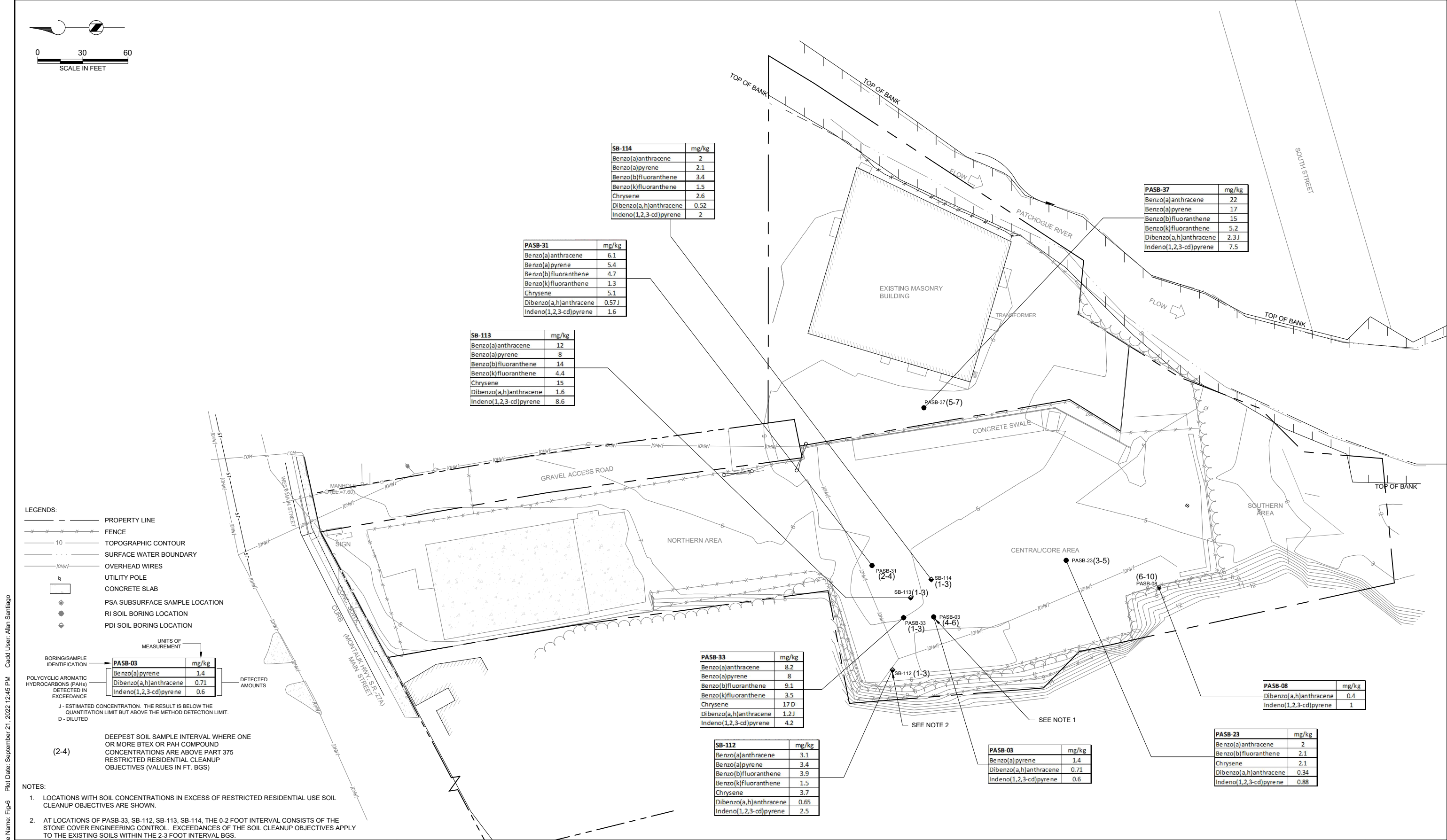
NOTES:
1. REFER TO FIGURE 3 FOR BASEMAP INFORMATION.



SCALE: 1" = 60'
153021
DATE: January 2021

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

WATER TABLE ELEVATION CONTOUR MAP
SEPTEMBER, 2020

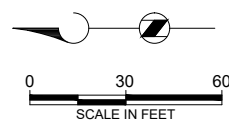


SCALE: 1" = 60'
153021
DATE: February 2021

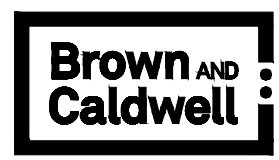
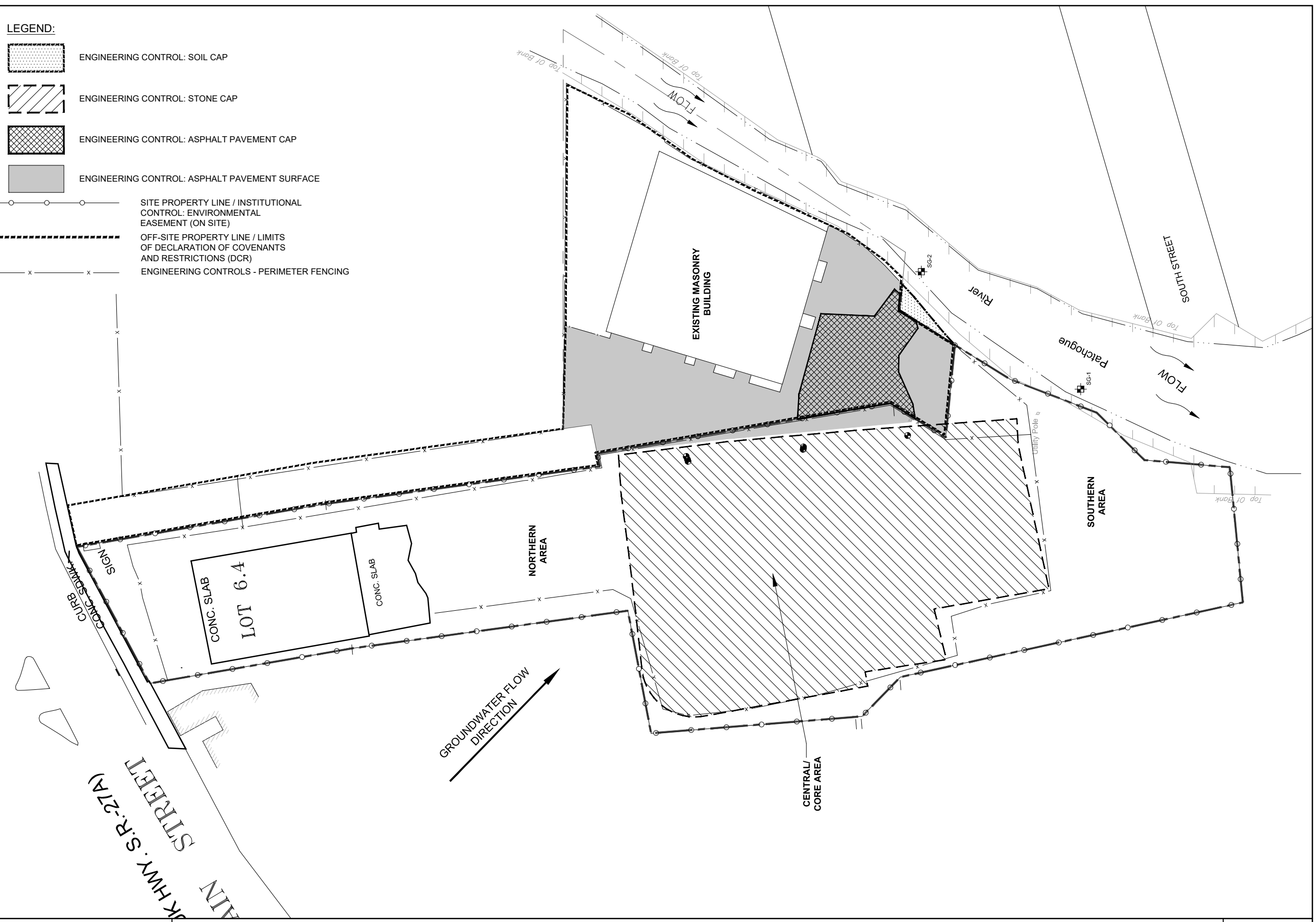
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

REMAINING SOIL SAMPLE EXCEEDANCES

Path: C:\bcpw\0901435 File Name: FIG-7_Controls Plot Date: February 19, 2021 7:26 AM Cadd User: Richard Johnson



- LEGEND:**
- ENGINEERING CONTROL: SOIL CAP
 - ENGINEERING CONTROL: STONE CAP
 - ENGINEERING CONTROL: ASPHALT PAVEMENT CAP
 - ENGINEERING CONTROL: ASPHALT PAVEMENT SURFACE
 - SITE PROPERTY LINE / INSTITUTIONAL CONTROL: ENVIRONMENTAL EASEMENT (ON SITE)
 - OFF-SITE PROPERTY LINE / LIMITS OF DECLARATION OF COVENANTS AND RESTRICTIONS (DCR)
 - ENGINEERING CONTROLS - PERIMETER FENCING



SCALE: 1" = 30'
153021
DATE: February 2021

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

INSTITUTIONAL AND ENGINEERING
CONTROL BOUNDARIES
AND LOCATIONS

APPENDIX A

ENVIRONMENTAL EASEMENT



SUFFOLK COUNTY CLERK
RECORDS OFFICE
RECORDING PAGE

Type of Instrument: EASEMENT
Number of Pages: 10
Receipt Number : 22-0159464
TRANSFER TAX NUMBER: 22-08612

Recorded: 11/16/2022
At: 11:48:21 AM
LIBER: D00013178
PAGE: 169

District: 0200 Section: 012.00 Block: 09.00 Lot: 006.004

EXAMINED AND CHARGED AS FOLLOWS

Deed Amount: \$0.00

Received the Following Fees For Above Instrument

		Exempt			Exempt
Page/Filing	\$50.00	NO	Handling	\$20.00	NO
COE	\$5.00	NO	NYS SRCHG	\$15.00	NO
TP-584	\$5.00	NO	Notation	\$0.00	NO
Cert.Copies	\$6.50	NO	RPT	\$200.00	NO
Transfer tax	\$0.00	NO			
			Fees Paid	\$301.50	

TRANSFER TAX NUMBER: 22-08612

THIS PAGE IS A PART OF THE INSTRUMENT
THIS IS NOT A BILL

JUDITH A. PASCALE
County Clerk, Suffolk County

1 2

3

Number of pages

10

TORRENS

Serial #

Certificate #

Prior Ctf. #

RECORDED
2022 Nov 16 11:48:21 AM
JUDITH A. PASCALE
CLERK OF
SUFFOLK COUNTY
L D00013178
P 169
DT# 22-08612

Deed / Mortgage Instrument	Deed / Mortgage Tax Stamp	Recording / Filing Stamps
4	FEES	

Page / Filing Fee	50		Mortgage Amt.	
Handling	20		1. Basic Tax	
TP-584	5		2. Additional Tax	
Notation			Sub Total	
EA-52 17 (County)		Sub Total	75	
EA-5217 (State)			Spec./Assit.	
R.P.T.S.A.	200 -		Or	
Comm. of Ed.	5 00		Spec./Add.	
Affidavit			TOT. MTG. TAX	
Certified Copy	16 50		Dual Town Dual County	
Reg. Copy		Sub Total	Held for Apportionment	
Other		GRAND TOTAL	Transfer Tax	
		206.50	Mansion Tax	
		301.50	The property covered by this mortgage is or will be improved by a one or two family dwelling only.	
			YES or NO	
			If NO, see appropriate tax clause on page # of this instrument.	



5	Real Property Tax Service Agency Verification				6	Community Preservation Fund	
Stamp	Dist.	Section	Block	Lot	Consideration Amount	\$	
0200	012.00	09.00	006.004		CPF Tax Due	\$	
Date					Improved		
Initials					Vacant Land		
7	Satisfactions/Discharges/Releases List Property Owners Mailing Address				TD		
RECORD & RETURN TO:				TD			
Barclay Damon LLP				TD			
125 Jefferson Street							
Syracuse, New York 13202							
Joan M. Lamson							

8	Title Company Information	
Co. Name	First American Title Ins. Co.	
Title #	3020-1147875*cq	

SUFFOLK COUNTY RECORDING & ENDORSEMENT PAGE

This page forms part of the attached Environmental Easement made by: (SPECIFY TYPE OF INSTRUMENT)

Keyspan Gas East Corp. The premises herein is situated in
SUFFOLK COUNTY, NEW YORK.
To
Department of Environmental Conservation In the Township of Brookhaven
In the VILLAGE or HAMLET of

BOXES 5 THRU 9 MUST BE TYPED OR PRINTED IN BLACK INK ONLY PRIOR TO RECORDING OR FILING.

IMPORTANT NOTICE

If the document you've just recorded is your SATISFACTION OF MORTGAGE, please be aware of the following:

If a portion of your monthly mortgage payment included your property taxes, *you will now need to contact your local Town Tax Receiver so that you may be billed directly for all future property tax statements.

Local property taxes are payable twice a year: on or before January 10th and on or before May 31st. Failure to make payments in a timely fashion could result in a penalty.

Please contact your local Town Tax Receiver with any questions regarding property tax payment.

Babylon Town Receiver of Taxes
200 East Sunrise Highway
North Lindenhurst, N.Y. 11757
(631) 957-3004

Brookhaven Town Receiver of Taxes
One Independence Hill
Farmingville, N.Y. 11738
(631) 451-9009

East Hampton Town Receiver of Taxes
300 Pantigo Place
East Hampton, N.Y. 11937
(631) 324-2770

Huntington Town Receiver of Taxes
100 Main Street
Huntington, N.Y. 11743
(631) 351-3217

Islip Town Receiver of Taxes
40 Nassau Avenue
Islip, N.Y. 11751
(631) 224-5580

Riverhead Town Receiver of Taxes
200 Howell Avenue
Riverhead, N.Y. 11901
(631) 727-3200

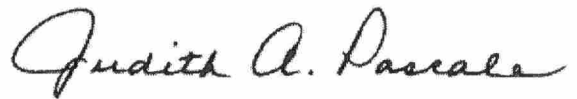
Shelter Island Town Receiver of Taxes
Shelter Island Town Hall
Shelter Island, N.Y. 11964
(631) 749-3338

Smithtown Town Receiver of Taxes
99 West Main Street
Smithtown, N.Y. 11787
(631) 360-7610

Southampton Town Receiver of Taxes
116 Hampton Road
Southampton, N.Y. 11968
(631) 283-6514

Southold Town Receiver of Taxes
53095 Main Street
Southold, N.Y. 11971
(631) 765-1803

Sincerely,



Judith A. Pascale
Suffolk County Clerk

dw
2/99

**ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36
OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW**

THIS INDENTURE made this 25th day of August, 2022 between Owner, KeySpan Gas East Corp., having an office at 175 East Old Country Road, Hicksville, County of Nassau, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 234 West Main Street in the Town of Brookhaven, County of Suffolk and State of New York, known and designated on the tax map of the County Clerk of Suffolk as tax map parcel number: Section 012.00 Block 09.00 Lot 006.004, being the same as that property conveyed to Grantor by deed dated May 25, 2005 and recorded in the Suffolk County Clerk's Office in Liber 12392 Page 560. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 1.99 +/- acres and is hereinafter more fully described in the Land Title Survey dated January 6, 2021 prepared by Joseph G. Malinowski, License No. 050314, of Engineering and Land Surveying, P.C., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: CO A2-0552-0606, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

**Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii),
Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial
as described in 6 NYCRR Part 375-1.8(g)(2)(iv)**

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Suffolk County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a

defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to: Site Number: 152182
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to: Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

KeySpan Gas East Corp.

By: Charles Willard

Print Name: Charles Willard JSY

Title: Authorized Representative Date: 8/16/2022

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Onondaga

On the 16 day of August, in the year 20 22 before me, the undersigned, personally appeared Charles Willard, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Kelly Marie Likens
Notary Public - State of New York



THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting by and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: Andrew Guglielmi
Andrew O. Guglielmi, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 25th day of August, in the year 2022 before me, the undersigned, personally appeared Andrew O. Guglielmi, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Jennifer Andoloro
Notary Public - State of New York

JENNIFER ANDALORO
Notary Public, State of New York
No. 02AN6098246
Qualified in Albany County 24
Commission Expires January 14, 2024

SCHEDULE "A" PROPERTY DESCRIPTION

ALL that certain plot, piece or parcel of land, situate, lying and being in the Incorporated Village of Patchogue, Town of Brookhaven, County of Suffolk and State of New York, bounded and described as follows:

Beginning at a point on the southeasterly side of West Main Street (NYS Route 27A, Montauk Highway) distant 357.36 feet northeasterly as measured along the southeasterly side of West Main Street from the corner formed by the intersection of the southeasterly side of West Main Street and the easterly side of River Avenue;

Running thence North 62 degrees 41 minutes 50 seconds East along the southeasterly side of West Main Street 94.71 feet to the westerly side of a 26 foot wide right of way;

Thence southerly along the westerly side of a 26 foot wide right of way the following two (2) courses and distances:

1. South 09 degrees 06 minutes 20 seconds East 153.29 feet;
2. South 07 degrees 03 minutes 50 seconds East 170.76 feet;

Thence North 79 degrees 08 minutes 30 seconds East 7.97 feet to land now or formerly of AB Corp;

Thence along the last mentioned land the following Three (3) courses and distances:

1. South 09 degrees 03 minutes 10 seconds East 182.14 feet;
2. South 32 degrees 32 minutes 00 seconds West 39.84 feet;
3. South 83 degrees 34 minutes 00 seconds East 57.00 feet to Patchogue River;

Thence along Patchogue River the following four (4) courses and distances:

1. South 32 degrees 32 minutes 00 seconds West 39.74 feet;
2. South 21 degrees 51 minutes 00 seconds West 57.00 feet;
3. South 45 degrees 37 minutes 00 seconds West 41.00 feet;
4. South 05 degrees 34 minutes 00 seconds West 52.57 feet;

Thence South 85 degrees 12 minutes 22 seconds West 83.16 feet to land now or formerly of Costanza's Suffolk Dock and General Contr. Inc.;

Thence along the last mentioned land the following two (2) courses and distances:

1. North 11 degrees 35 minutes 08 seconds West 214.63 feet;
2. North 44 degrees 58 minutes 00 seconds West 33.68 feet to land now or formerly of Kocarnik;

Thence along the last mentioned land and along land now or formerly of NRLA Realty Inc. the following six (6) courses and distances:

1. North 03 degrees 46 minutes 02 seconds West 3.38 feet;
2. North 03 degrees 49 minutes 57 seconds West 124.07 feet;
3. North 07 degrees 22 minutes 02 seconds West 2.14 feet;
4. North 80 degrees 01 minute 37 seconds East 76.46 feet;
5. North 07 degrees 03 minutes 50 seconds West 170.76 feet;
6. North 09 degrees 06 minutes 20 seconds West 125.58 feet to the southeasterly side of West Main Street, to the point or place of BEGINNING, containing 1.99± acres of land, more or less.

APPENDIX B

LIST OF SITE CONTACTS

APPENDIX B – LIST OF CONTACTS FOR SITE PROPERTY AND OFF-SITE PROPERTY

This Appendix includes a list of Site contacts. The below table should be edited as necessary to include Site contacts necessary for implementation of the SMP.

Name	Phone/Email Address
Site Owner: National Grid	516-220-4363 michael.quinlan@nationalgrid.com
Off-Site Property Owner: Above All Store Fronts	516-220-4363 michael.quinlan@nationalgrid.com
Remedial Party/Respondent: National Grid	516-220-4363 michael.quinlan@nationalgrid.com
National Grid's Qualified Environmental Professional: Keith Bogatch	201-574-4700 kbogatch@brwnald.com
NYSDEC DER Project Manager: Gerald Pratt	518-402-9667; gerald.pratt@dec.ny.gov
NYSDOH Public Health: Jacquelyn Nealon	800 458-1158 x27880; Jacquelyn.nealon@health.ny.gov
On and Off-Site access contacts such as tenants, adjacent property owners, etc.: See Property Owners above	See Property Owners above
Remedial Party/Respondent Attorney: Frank Murphy, Esq. National Grid- Legal Dept. 175 East Old Country Road Hicksville, NY 11801	516-545-3745 francis.murphy@nationalgrid.com

APPENDIX C

SOIL BORING AND MONITORING WELL CONSTRUCTION LOGS

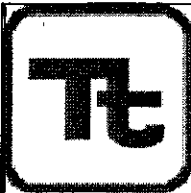


Project Name: Former Patchogue MGP	Site Id: MW-1
Township/Range: Patchogue, New York	Coordinate X: 1255132.53
Logged By: Tom Fowler	Coordinate Y: 219674.03
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 01/28/08

Remarks:

Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
40							
1		FI		0-2: Dark Gray Brown fine SAND and organic silt, some decomposed wood;	01/28/08	0 ppm	Instolled 2" monitoring well.
2				2-4.6: Dark Gray Brown fine to medium SAND, some silt, moist		0 ppm	
3		SM				0 ppm	
4						0 ppm	
5	96	GM		4.6-5: Dark Gray Brown GRAVEL and silty sand, little organics, wet	01/28/08		No PID hits in any portion.
6				5-10: Dark Gray Brown/Dark Brown fine to medium SAND, some organic silt, little gravel, medium dense, wet		0 ppm	
7						0 ppm	Screened 7-12' bgs.
8						0 ppm	
9						0 ppm	
10	90	SM		10-15: Gray Brown fine to medium SAND medium dense, wet	01/28/08		
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP

Site Id: MW-1

Township/Range: Patchogue, New York

Coordinate X: 1255132.53

Logged By: Tom Fowler

Coordinate Y: 219674.03

Drilling Method: Geoprobe

Total Depth: 15.00'

Date Started: 01/28/08

Remarks:

Date Completed: 01/28/08

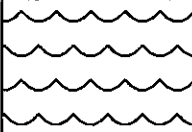
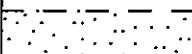
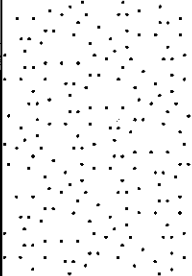
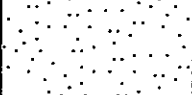
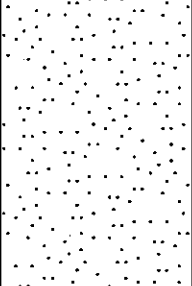
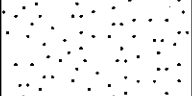
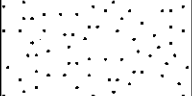
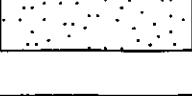
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

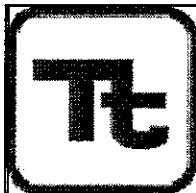


Project Name: Former Patchogue MGP	Site Id: MW-2D
Township/Range: Patchogue, New York	Coordinate X: 1255112.75
Logged By: Tom Fowler	Coordinate Y: 219348.84
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08

Remarks:

Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
36		PT		0-1.5: Brown PEAT	02/04/08	0 ppm	
1						0 ppm	
2				1.5-5: Dark Brown fine to medium SAND, medium density, moist to wet.		0 ppm	
3						0 ppm	
4						0 ppm	
5	28	SP		5-10: Gray Brown fine to coarse SAND, little gravel, medium density, wet	02/04/08	0 ppm	PASBMW2D-6-10 Full TCL
6						0 ppm	
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	46	SP		10-15: Gray Brown fine to medium SAND, medium density, wet; from 10-10.4 orange brown	02/04/08	0 ppm	
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: MW-2D
Township/Range: Patchogue, New York	Coordinate X: 1255112.75
Logged By: Tom Fowler	Coordinate Y: 219348.84
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08

Remarks:

Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15-20: Gray Brown fine to medium SAND, medium density, wet; from 18-19 medium brown	02/04/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	40			20-25: Gray Brown fine to medium SAND, medium density, wet	02/04/08	0 ppm	Screened 20 - 25' bgs
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: MW-2S

Township/Range: Patchogue, New York

Coordinate X: 1255107.89

Logged By: Tom Fowler

Coordinate Y: 219370.35

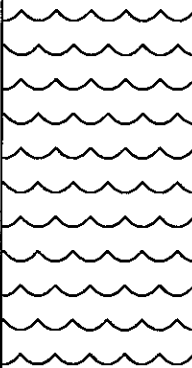
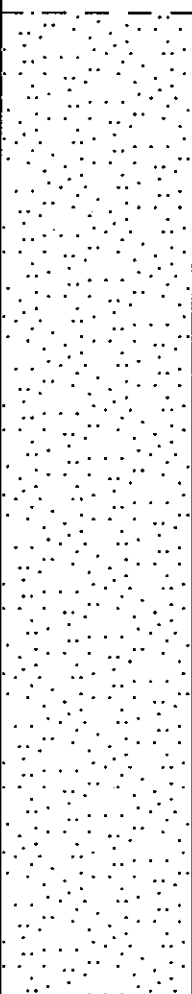
Drilling Method: Geoprobe

Total Depth: 15.00'

Date Started: 01/28/08

Remarks:

Date Completed: 01/28/08

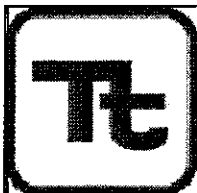
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	30	PT		0-4: Dark Brown PEAT	01/28/08	0 ppm	Installed a 2" well
1						0 ppm	
2						0 ppm	
3						0 ppm	
4		SP		4-4.2: Dark Brown fine to coarse SAND, little gravel	01/28/08	0 ppm	
5	0			4.2-5: Yellow Brown fine to medium SAND, medium density, wet			No PID readings around backfill or empty tube
6				5-10: No Recovery			Screened 5-10' bgs
7					01/28/08		
8							
9							
10	0			10-15: No Recovery	01/28/08		
11							
12							
13							
14							



Project Name: Former Patchogue MGP	Site Id: MW-2S
Township/Range: Patchogue, New York	Coordinate X: 1255107.89
Logged By: Tom Fowler	Coordinate Y: 219370.35
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 01/28/08
	Date Completed: 01/28/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: MW-2X
Township/Range: Patchogue, New York	Coordinate X: 1255109.58
Logged By: Tom Fowler	Coordinate Y: 219369.97
Drilling Method: Geoprobe	Total Depth: 5.00'
	Date Started: 02/04/08
	Date Completed: 02/04/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0							
1							
2							
3		FI					
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

0-5: Gray Brown Silty SAND with some wood chips, some glass fragments, some tarry globules, strong odor, moist

02/04/08

28 ppm

Bottom on foot of Lexan or Macro tube is squashed. Located 15 ft. south of MW-2S.

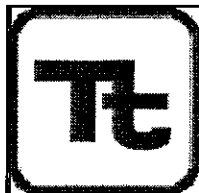


Project Name: Former Patchogue MGP	Site Id: MW-3
Township/Range: Patchogue, New York	Coordinate X: 1255328.74
Logged By: Tom Fowler	Coordinate Y: 219200.31
Drilling Method: Geoprobe	Total Depth: 10.00'
	Date Started: 01/28/08

Remarks:

Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
1	70	SM		0-4: Dark Brown/Dark Gray fine to medium SAND and silt, some gravel, medium density, moist	01/28/08	0 ppm	Install 2" well.
2						0 ppm	
3						0 ppm	
4						0 ppm	
5	96	SP		4-5: Gray Brown fine to medium SAND little silt, trace gravel, medium density, wet	01/28/08	0 ppm	Screened 5-10' bgs.
6		SM		5-7: Dark Brown fine to medium SAND and peat, wet		0 ppm	
7				7-8: Gray Brawn fine to coarse SAND and gravel, medium density, wet		0 ppm	
8		SP		8-9: Orange Brown/Light Gray fine to coarse SAND, medium density, wet		0 ppm	
9				9-10: Gray fine to coarse SAND and gravel, medium density, wet		0 ppm	
10							
11							
12							
13							
14							



Project Name: Former Patchogue MGP

Site Id: MW-4D

Township/Range: Patchogue, New York

Coordinate X: 1255291.58

Logged By: Tom Fowler

Coordinate Y: 219134.53

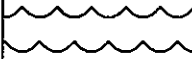
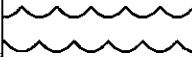
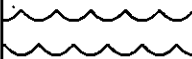
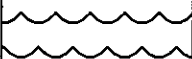
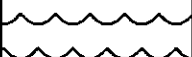
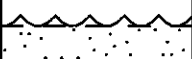
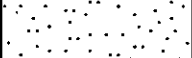
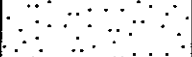
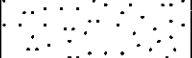
Drilling Method: Geoprobe

Total Depth: 25.00'

Date Started: 02/04/08

Remarks:

Date Completed: 02/04/08

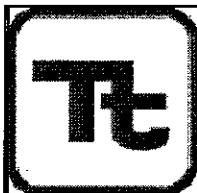
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60	PT		0-5: Dark Brown PEAT, some sand, some gravel, little wood, moist	02/04/08	0 ppm	Installed 2" well
1						0 ppm	
2						0 ppm	
3						0 ppm	
4						0 ppm	
5	26			5-6: Dark Brown PEAT	02/04/08	0 ppm	PASBMW4D-5-10 Full TCL
6						0 ppm	
7				6-10: Gray Brown fine to coarse SAND, little gravel, medium density, wet		0 ppm	
8						0 ppm	
9						0 ppm	
10	18			10-15: Orange Brown fine to coarse SAND, medium density, wet	02/04/08	0 ppm	
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: MW-4D
Township/Range: Patchogue, New York	Coordinate X: 1255291.58
Logged By: Tom Fowler	Coordinate Y: 219134.53
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08
	Date Completed: 02/04/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	46	SP		15-18: Orange Brown fine to medium SAND	02/04/08		Little bog iron
16						0 ppm	
17						0 ppm	
18				18-20: Orange Brown fine to coarse SAND and gravel, medium density, wet		0 ppm	
19						0 ppm	
20	30			20-25: Light Brown fine to coarse SAND, medium density, wet	02/04/08		Screened 20 - 25' bgs
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

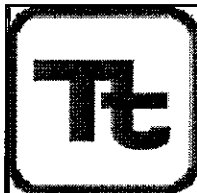


Project Name: Former Patchogue MGP	Site Id: MW-4S
Township/Range: Patchogue, New York	Coordinate X: 1255290.45
Logged By: Tom Fowler	Coordinate Y: 219131.47
Drilling Method: Geoprobe	Total Depth: 10.00'
	Date Started: 01/28/08

Remarks:

Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	40	FI		0-5: Dark Brown fine to medium SAND and organic Silt, little misc. debris, brick fragments, weathered wood, medium density, wet	01/28/08		Install 2" well
1						0 ppm	
2						0 ppm	
3						0 ppm	
4						0 ppm	
5	60	PT		5-7: Brown weathered wood, wet	01/28/08		Screened 5-10' bgs
6						0 ppm	
7						0 ppm	
8		SP		7-8.5: Dark Brown PEAT, gray fine sand zone (7.3-7.6')			
9						0 ppm	
10						0 ppm	
11				8.5-10: Gray Brown fine to medium SAND, some gravel, medium density, wet			
12							
13							
14							



Project Name: Former Patchogue MGP

Site Id: PASB-16

Township/Range: Patchogue, New York

Coordinate X: 1255166.56

Logged By: Tom Fowler

Coordinate Y: 219201.68

Drilling Method: Geoprobe

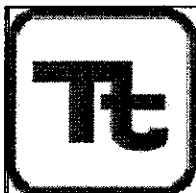
Total Depth: 10.00'

Date Started: 02/01/08

Remarks:

Date Completed: 02/01/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
70							
1		FI		0-3: Dark Gray Brown fine to coarse SAND and gravel, some brick	02/01/08	0 ppm	
2						0 ppm	
3		SM		3-5: Brown/Dark Brown fine to medium SAND, some peat		0 ppm	
4						0 ppm	
5	42			5-10: Gray Brown fine to coarse SAND, little to some gravel (increasing with depth), medium density, wet	02/01/08		
6						0 ppm	
7		SP				0 ppm	
8						0 ppm	
9						0 ppm	
10							
11							
12							
13							
14							



Project Name: Former Patchogue MGP

Site Id: PASB-17

Township/Range: Patchogue, New York

Coordinate X: 1255178.34

Logged By: Tom Fowler

Coordinate Y: 219142.26

Drilling Method: Geoprobe

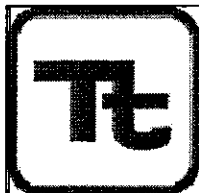
Total Depth: 10.00'

Date Started: 02/01/08

Remarks:

Date Completed: 02/01/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
64		FI		0-0.5: Brown silty SAND and gravel, brick	02/01/08		
1		SP		0.5-1.5: Brown fine to medium SAND		0 ppm	
2				1.5-5: Brown fine to medium SAND and varying amounts of peat		0 ppm	
3		SM				0 ppm	
4						0 ppm	
5	54			5-7: Brown fine to medium SAND, little peat, wet	02/01/08		
6						0 ppm	
7		SP		7-10: Gray to Yellow Brown fine to coarse SAND, some gravel, medium density, wet		0 ppm	
8						0 ppm	
9						0 ppm	
10							
11							
12							
13							
14							



Project Name: Former Patchogue MGP

Site Id: PASB-18

Township/Range: Patchogue, New York

Coordinate X: 1255200.28

Logged By: Tom Fowler

Coordinate Y: 219060.21

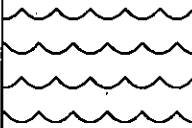
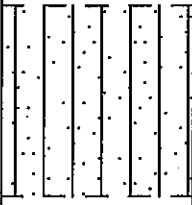
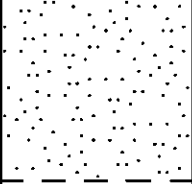
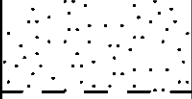
Drilling Method: Hand Auger

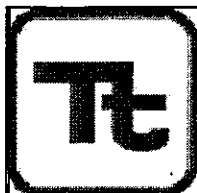
Total Depth: 7.50'

Date Started: 02/08/08

Remarks:

Date Completed: 02/08/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
1		PT		0-1.5: Gray Black PEAT, some sand, leaves. very soft.	02/08/08	0 ppm	
2		SM		1.5-3.5: Gray Brown fine to medium SAND, some silt, wet	02/08/08	0 ppm	
3						0 ppm	
4		PT		3.5-4: Dark Brown PEAT	02/08/08	0 ppm	
5		SP		4-6: Gray Brown fine to coarse SAND, trace gravel, wet	02/08/08	0 ppm	
6						0 ppm	
7		PT		6-6.5: Brown PEAT	02/08/08	0 ppm	
8		SP		6.5-7.5: Yellow Brown fine to coarse SAND and gravel (sub-rounded)	02/08/08	0 ppm	
9							
10							
11							
12							
13							
14							

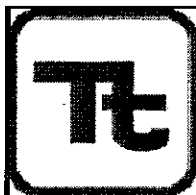


Project Name: Former Patchogue MGP	Site Id: PASB-19
Township/Range: Patchogue, New York	Coordinate X: 1255201.64
Logged By: Tom Fowler	Coordinate Y: 219121.74
Drilling Method: Geoprobe	Total Depth: 10.00'
	Date Started: 01/29/08

Remarks:

Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60	FI		0-1.5: Dark Brown fine SAND, some gravel, brick fragments	01/29/08	0 ppm	
1							
2		SP		1.5-4: Gray Brown to Gray Black fine to medium SAND and gravel, some silt		0 ppm	
3						0 ppm	3-4: Dark staining
4		SM		4-5: Dark Brown fine to medium SAND, some silt		0 ppm	PASB19-2-4 Hg only
5	66	GM		5-6: Dark Brown GRAVEL and silt, some sand, wet	01/29/08		
6				6-8: Dark Brown PEAT		0 ppm	PASB19-6-10 Hg only
7		PT				0 ppm	
8				8-10: Gray Brown to Orange Brown fine to coarse SAND and gravel, wet		0 ppm	
9		SP				0 ppm	
10							
11							
12							
13							
14							



Project Name: Former Patchogue MGP

Site Id: PASB-20

Township/Range: Patchogue, New York

Coordinate X: 1255212.00

Logged By: Tom Fowler

Coordinate Y: 219226.72

Drilling Method: Geoprobe

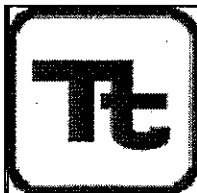
Total Depth: 25.00'

Date Started: 01/29/08

Remarks:

Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	62	FI		0-3: Dark Gray Brown GRAVEL and silty sand, broken bricks	01/29/08	0 ppm	
1							
2							
3							
4				3-5: Gray Black/Gray Brown fine to medium SAND, medium density, wet	01/29/08	0 ppm	
5	60						
6							
7							
8							
9							
10	52	SP		5-10: Gray Brown fine to medium SAND, medium density, wet	01/29/08	0 ppm	8-8.5: Gray-black staining, slight odor PASB20-8-10 Full TCL
11							
12							
13							
14							
				10-15: Yellow Brown fine to medium SAND, medium density, wet	01/29/08	0 ppm	PASB20-11-13 Full TCL

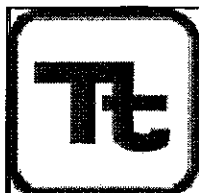


Project Name: Former Patchogue MGP	Site Id: PASB-20
Township/Range: Patchogue, New York	Coordinate X: 1255212.00
Logged By: Tom Fowler	Coordinate Y: 219226.72
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08

Remarks:

Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	26			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/29/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Orange Brown fine to medium SAND, medium density, wet	01/29/08	0 ppm	
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

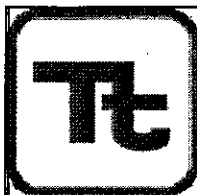


Project Name: Former Patchogue MGP	Site Id: PASB-21
Township/Range: Patchogue, New York	Coordinate X: 1255248.57
Logged By: Tom Fowler	Coordinate Y: 219230.19
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08

Remarks:

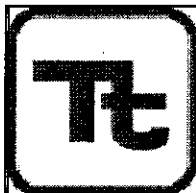
Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
68		FI		0-3: Dark Gray silty SAND and gravel-sized brick and concrete	01/30/08	0 ppm	
1						0 ppm	
2						0 ppm	
3				3-5: Dark Gray Brown fine to medium SAND, some silt		0 ppm	Very slight odor
4		SP				0.1 ppm	PASB21-3-5 Full TCL
5	48			5-8: Dark Gray Brown fine to coarse SAND, medium density, wet	01/30/08	0 ppm	
6						0 ppm	
7						0 ppm	
8				8-10: Yellow Brown fine to medium SAND, medium density, wet;		0 ppm	
9						0 ppm	
10	44			10-15: Yellow Brown fine to medium SAND, little gravel, wet	01/30/08	0 ppm	PASB21-11-13 Full TCL
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-21
Township/Range: Patchogue, New York	Coordinate X: 1255248.57
Logged By: Tom Fowler	Coordinate Y: 219230.19
Drilling Method: Geoprobe	Total Depth: 25.00'
Remarks:	Date Started: 01/30/08
	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15-20: Yellow Brown fine to coarse SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19	0 ppm						
20	36			20-25: Yellow Brownfine to coarse SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: PASB-22

Township/Range: Patchogue, New York

Coordinate X: 1255229.01

Logged By: Tom Fowler

Coordinate Y: 219254.82

Drilling Method: Geoprobe

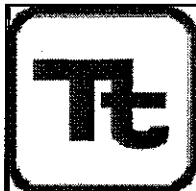
Total Depth: 25.00'

Date Started: 01/30/08

Remarks:

Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60	FI		0-2: Gray/Red Brown GRAVEL with brick fragments and silty sand	01/30/08	3 ppm	PASB22-3-5 Full TCL moderate odor
1							
2				2-5: Dark Gray/Black fine to coarse SAND and gravel		ppm	
3						ppm	
4						ppm	
5	46			5-5.5: Gray Black SAND with some wood fibers	01/30/08		
6				5.5-7: Gray fine to medium SAND, medium density, wet		8 ppm	
7				7-10: Yellow Brown fine to coarse SAND, some gravel, medium density, wet		1 ppm	
8						0 ppm	
9						0 ppm	
10	64			10-15: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		PASB22-11-13 Full TCL
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	

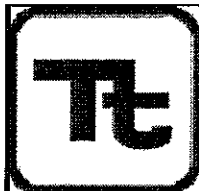


Project Name: Former Patchogue MGP	Site Id: PASB-22
Township/Range: Patchogue, New York	Coordinate X: 1255229.01
Logged By: Tom Fowler	Coordinate Y: 219254.82
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08

Remarks:

Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	54	SP		15-20: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	36			20-25: Yellow Brown fine to coarse SAND, medium density, wet.	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

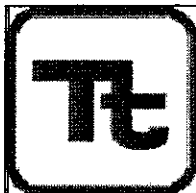


Project Name: Former Patchogue MGP	Site Id: PASB-22A
Township/Range:	Coordinate X: 1255232.92
Logged By: T. Fowler	Coordinate Y: 219254.20
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 07/08/08

Remarks:

Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	64	SM		0-0.5: Grey brown silty SAND, some gravel	07/08/08		
		SM		0.5-1: Dark brown to black fine to coarse silty SAND, some gravel	07/08/08	0 ppm	
2		SM		1-3: Dark brown silty SAND, brick, concrete, and cobble fragments, moist to wet	07/08/08	0 ppm	
3				3-5: Grey brown, fine to medium silty SAND, some silt, medium dense, wet	07/08/08	0 ppm	3-5: black tar saturated wood shavings and soil; naphthalene-like odor
4		SM					
5	60			5-8: Dark brown fine to medium SAND, some silt, concrete fragments, wet	07/08/08	0 ppm	5-8: black tar saturated soil; naphthalene-like odor
6		SM					
7							
8				8-10: Dark brown to black fine to medium SAND, some silt, some gravel, wood shavings, wet	07/08/08	0 ppm	8-8.2: black tar saturated soil
9		SM					8.4-8.8: black tar saturated soil
10	40			10-13: Brown fine to coarse SAND, some gravel, little silt, wet	07/08/08	0 ppm	9.1-9.2: orange brown staining
11		SP					
12							
13				13-14.5: Brown silty SAND, interlayered with dark brown peat, wet	07/08/08		
14		SM					

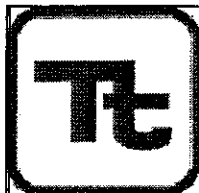


Project Name: Former Patchogue MGP	Site Id: PASB-22A
Township/Range:	Coordinate X: 1255232.92
Logged By: T. Fowler	Coordinate Y: 219254.20
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 07/08/08

Remarks:

Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15		SP		14.5-15: Brown, fine to coarse SAND, some gravel, medium dense, wet	07/08/08		14.5: 1 inch wide black coating
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: PASB-23

Township/Range: Patchogue, New York

Coordinate X: 1255184.73

Logged By: Tom Fowler

Coordinate Y: 219238.23

Drilling Method: Geoprobe

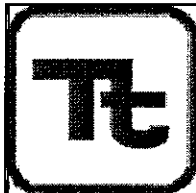
Total Depth: 25.00'

Date Started: 01/30/08

Date Completed: 01/30/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60	FI		0-3: Dark Brown Sand and Silt, some brick and concrete fragments	01/30/08	0.4 ppm	
1						ppm	
2						ppm	
3				3-5: Gray Black fine SAND, some silt		ppm	very slight odor
4						ppm	PASB23-3-5
5	44	PT		5-7: Dark Gray Brown fine to medium SAND, medium density, wet	01/30/08		Full TCL
6						0 ppm	
7				7-8.5: Brown Wood weathered		0 ppm	
8						0 ppm	
9				8.5-8.8: Brown PEAT		0 ppm	
10	74			8.8-10: Gray fine to coarse SAND, medium density, wet		0 ppm	
11				10-11: Gray fine to medium SAND, medium density, wet	01/30/08		
12				11-15: Yellow Brown fine to medium SAND, medium density, wet		0 ppm	
13						0 ppm	PASB23-12-15
14						0 ppm	Full TCL MS/MSD



Project Name: Former Patchogue MGP	Site Id: PASB-23
Township/Range: Patchogue, New York	Coordinate X: 1255184.73
Logged By: Tom Fowler	Coordinate Y: 219238.23
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08

Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15		SP		15-20: Gray Brown fine to medium SAND, medium density, wet	01/30/08		PASB23-15-20 Full TCL
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20				20-25: Orange Brown fine to coarse SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: PASB-24

Township/Range: Patchogue, New York

Coordinate X: 1255153.34

Logged By: Tom Fowler

Coordinate Y: 219238.01

Drilling Method: Geoprobe

Total Depth: 25.00'

Date Started: 02/01/08

Remarks:

Date Completed: 02/01/08

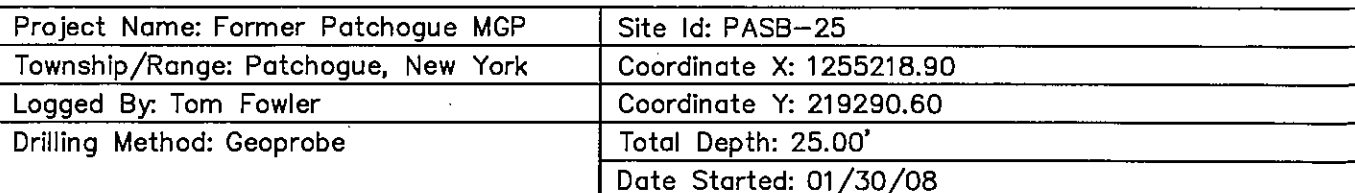
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
68		FI		0-3: Dark Brown silty SAND, some gravel, concrete, moist	02/01/08		
1						0 ppm	
2						0 ppm	
3				3-5: Brown fine to coarse SAND, grading to peat and sand, moist		0 ppm	
4		SM				0 ppm	
5	72			5-7.5: Brown fine to coarse SAND and peat	02/01/08		PASB24-5-10 Full TCL (MS/MSD)
6						0 ppm	
7						0 ppm	
8				7.5-10: Gray Brown fine to coarse SAND, some peat zones		0 ppm	
9						0 ppm	
10	64			10-15: Yellow Brown/Gray Brown fine to coarse SAND, some gravel, medium density, wet	02/01/08		PASB24-10-15 Geotech
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-24
Township/Range: Patchogue, New York	Coordinate X: 1255153.34
Logged By: Tom Fowler	Coordinate Y: 219238.01
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/01/08

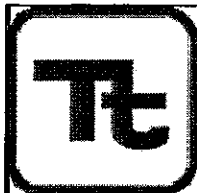
Remarks:	Date Completed: 02/01/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60	SP		15-20: Yellow Brown fine to medium SAND, medium density, wet	02/01/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	64			20-25: Yellow Brown/Dark Brown fine to coarse SAND, medium density, wet	02/01/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



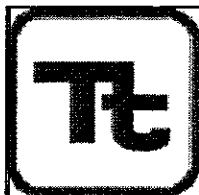
Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60	FI		0-3: Dark Gray/Black fine to medium SAND, some gravel	01/30/08	6 ppm	moderate odor PASB25-1-6 and PASB25-31-36 (duplicate) Full TCL
1							
2							
3							
3				3-5: Gray Black fine to medium SAND, loose, moist			
4							
5	46			5-7: Dark Reddish Brown fine to medium SAND, medium density, wet	01/30/08	120 ppm	Strong odor
6							
7							
8							
9							
10	48						
11				10-15: Red Brown/Orange Brown fine to medium SAND, medium density, wet	01/30/08	38 ppm	9-9.2: red brown oily staining PASB25-9-14 Full TCL
12							
13							
14							
		SP				4 ppm	13.8-14: Dork brown oily staining



Project Name: Former Patchogue MGP	Site Id: PASB-25
Township/Range: Patchogue, New York	Coordinate X: 1255218.90
Logged By: Tom Fowler	Coordinate Y: 219290.60
Drilling Method: Geoprobe	Total Depth: 25.00'
Remarks:	Date Started: 01/30/08
	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	54			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	58			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: PASB-26

Township/Range: Patchogue, New York

Coordinate X: 1255268.34

Logged By: Tom Fowler

Coordinate Y: 219260.97

Drilling Method: Geoprobe

Total Depth: 25.00'

Date Started: 01/31/08

Remarks:

Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
74							
1		FI		0-3: Dark Brown Silty SAND and gravel (concrete), moist	01/31/08		
2							
3							
4		GM		3-4.5: Gray Black GRAVEL and fine to coarse sand, wet		42 ppm	Strong odor
5	60			4.5-5: Gray Black fine to coarse SAND			Oily appearance
6				5-8.5: Dark Gray Brown fine to coarse SAND, medium density, wet	01/31/08	70 ppm	PASB26-4-6 Full TCL
7							
8							
9				8.5-10: Gray to Brown fine to coarse SAND, some gravel			
10	66			10-15: Yellow Brown fine to coarse SAND becoming fine to medium, medium density, wet	01/31/08		
11						0 ppm	PASB26-11-13 Full TCL
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-26
Township/Range: Patchogue, New York	Coordinate X: 1255268.34
Logged By: Tom Fowler	Coordinate Y: 219260.97
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
	Date Completed: 01/31/08

Remarks:

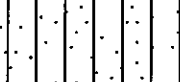
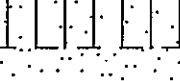
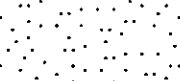
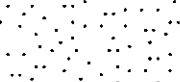
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	56	SP		15-20: Orange Brown fine to medium SAND, medium density, wet	01/31/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Orange Brown fine to medium SAND, medium density, wet	01/31/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP
Township/Range: Patchogue, New York
Logged By: Tom Fowler
Drilling Method: Geoprobe

Site Id: PASB-27
Coordinate X: 1255270.27
Coordinate Y: 219215.68
Total Depth: 25.00'
Date Started: 01/30/08
Date Completed: 01/30/08

Remarks:

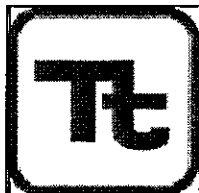
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	70	SM		0-3: Dark Gray Brown fine to medium SAND with some silt	01/30/08	0 ppm	slight odor near top of core
1						0 ppm	
2						0 ppm	
3				3-5: Gray Black fine to coarse SAND and gravel, medium density		0 ppm	
4						0 ppm	PASB27-4-6 Full TCL
5	62	SP		5-10: Dark Gray fine to coarse SAND, little gravel, medium density, wet	01/30/08	0.3 ppm	
6							
7							
8							
9							
10	68			10-15: Yellow Brown fine to medium SAND, grayish spots at 10.5-13.5	01/30/08	0 ppm	
11						0 ppm	
12						0 ppm	
13						0 ppm	PASB27-13-15 Full TCL
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-27
Township/Range: Patchogue, New York	Coordinate X: 1255270.27
Logged By: Tom Fowler	Coordinate Y: 219215.68
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
	Date Completed: 01/30/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	62			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-28
Township/Range: Patchogue, New York	Coordinate X: 1255260.92
Logged By: Tom Fowler	Coordinate Y: 219331.47
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08

Remarks:

Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
74		FI		0-1: Dark Gray silty SAND and gravel (brick fragments), moist	01/31/08		
1				1-3: Gray Black fine to coarse SAND, moist		34 ppm	Moderate to strong odor
2		SP					PASB 28- 1-3
3		PT		3-3.4: Brown PEAT			Full TCL
4				3.4-5: Dark Gray Brown fine to coarse SAND, medium density, moist			
5	40			5-10: Gray to Brown fine to coarse SAND, medium density, wet	01/31/08		
6						0 ppm	
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	54			10-15: Yellow Brown fine to coarse SAND, little gravel, medium density, wet	01/31/08		
11						0 ppm	PASB28-11-13
12						0 ppm	Full TCL
13						0 ppm	
14		SP				0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-28
Township/Range: Patchogue, New York	Coordinate X: 1255260.92
Logged By: Tom Fowler	Coordinate Y: 219331.47
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08

Remarks:

Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	58			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-28A
Township/Range:	Coordinate X: 1255256.72
Logged By: T. Fowler	Coordinate Y: 219333.84
Drilling Method: Geoprobe	Total Depth: 5.00'
	Date Started: 07/08/08
	Date Completed: 07/08/08

Remarks:

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	48	SP		0-5: Orange-brown, fine to medium SAND, trace gravel, medium dense, wet	07/08/08	0 ppm	Water Table ~0.8 feet bgs in borehole
2						0 ppm	
3						0 ppm	
4						0 ppm	
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							



Project Name: Former Patchogue MGP	Site Id: PASB-29
Township/Range: Patchogue, New York	Coordinate X: 1255237.72
Logged By: Tom Fowler	Coordinate Y: 219354.91
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
	Date Completed: 01/31/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
66							
1		FI		0-3: Dark Gray fine to coarse SAND, and gravel, some silt	01/31/08	6 ppm	
2							
3				3-5: Gray Black fine to medium SAND			Some odor
4		SP				6 ppm	
5	70			5-6.5: Brown PEAT, fine to coarse sand zones, wet.	01/31/08	1 ppm	
6		PT					
7				6.5-9: Dark Brown fine to coarse SAND, and gravel;		1 ppm	
8							
9				9-10: Brown fine to medium SAND, medium density, wet			
10	58			10-15: Light Brown fine to medium SAND, medium density, wet	01/31/08		
11						0 ppm	Dark stain 11-11.3'
12						0 ppm	
13						0 ppm	
14						0 ppm	

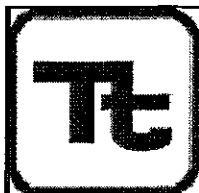


Project Name: Former Patchogue MGP	Site Id: PASB-29
Township/Range: Patchogue, New York	Coordinate X: 1255237.72
Logged By: Tom Fowler	Coordinate Y: 219354.91
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08

Remarks:

Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	46	SP		15-20: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	40			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-30
Township/Range: Patchogue, New York	Coordinate X: 1255205.35
Logged By: Tom Fowler	Coordinate Y: 219351.12
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
	Date Completed: 01/31/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	62	FI		0-2: Dark Gray Brown GRAVEL and silty sand, slightly moist	01/31/08		
1							
2				2-5: Dark Brown to Gray Black fine to medium SAND			
3		SP					moderately strong odor and oily appearance
4						99 ppm	
5	52			5-10: Brown fine to coarse SAND, little gravel, medium density, wet, light gray 8-8.4	01/31/08		PASB30-4-6 and PASB30-34-36 (duplicate) Full TCL
6							
7							
8		SP				159 ppm	Gray black oily zones 8-8.5' and 9-9.6'
9							
10	54			10-15: Gray Brown fine to medium SAND, medium density, wet.	01/31/08		
11							
12							
13		SP				8 ppm	
14							



Project Name: Former Patchogue MGP

Site Id: PASB-30

Township/Range: Patchogue, New York

Coordinate X: 1255205.35

Logged By: Tom Fowler

Coordinate Y: 219351.12

Drilling Method: Geoprobe

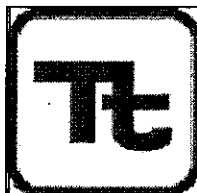
Total Depth: 25.00'

Date Started: 01/31/08

Remarks:

Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	52			15-20: Gray to Light Brown fine to medium SAND, medium density, wet	01/31/08	1 ppm	oily stained from 17.8-18' and 19.5-19.7'
16							
17							
18							
19							
20	46			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		PASB30-21-25 Full TCL (MS/MSD)
21							
22							
23						0 ppm	
24							
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-31
Township/Range: Patchogue, New York	Coordinate X: 1255181.32
Logged By: Tom Fowler	Coordinate Y: 219367.33
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08

Remarks:

Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	70	FI		0-1: Gray Brown GRAVEL (some brick fragments) and silty sand, wet at 1' bgs	01/29/08	4 ppm	1-2: some odor iridescent sheen ~3' bgs
1				1-2: Gray to Black fine to medium SAND, wet			2.0-4.5: moderate odor
2				2-5: Gray to Black fine to medium SAND, wet			PASB31-2-4 and PASB31-32-34 (duplicate)
3							Full TCL
4							Lighter color with depth
5	40	SP		5-10: Light Brown to Brown fine to coarse SAND, medium density	01/29/08	0 ppm	
6						0 ppm	
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	30			10-15: Yellow Brown fine to medium SAND, medium density, wet	01/29/08	0 ppm	PASB31-10-15 Full TCL
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP

Site Id: PASB-31

Township/Range: Patchogue, New York

Coordinate X: 1255181.32

Logged By: Tom Fowler

Coordinate Y: 219367.33

Drilling Method: Geoprobe

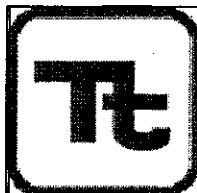
Total Depth: 25.00'

Date Started: 01/29/08

Remarks:

Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15-20: Brown fine to medium SAND, medium density, wet	01/29/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	44			20-25: Yellow Brown to Gray Brown fine to medium SAND, medium density, wet	01/29/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-31A
Township/Range:	Coordinate X: 1255182.02
Logged By: T. Fowler	Coordinate Y: 219362.81
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 07/08/08

Remarks:

Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	66	SP		0-3: Dark brown to grey brown fine to medium SAND, moist to wet	07/08/08	0 ppm	
2						0 ppm	
3						0 ppm	
4		SP		3-4.5: Dark grey brown fine to medium SAND, wet	07/08/08	0 ppm	3-4.5: naphthalene-like odor, black staining
5	90	SP		4.5-5: Light grey fine to medium SAND, wet	07/08/08		4.5-5: black staining
6		SP		5-10: Dark grey brown grading to light grey and then light brown fine to coarse SAND, wet	07/08/08	0 ppm	5-10: trace naphthalene-like odor
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	52			10-10.4: Light brown medium to coarse SAND, little gravel, wet	07/08/08	0 ppm	
11		SP		10.4-15: Light grey brown fine to medium SAND, wet	07/08/08	0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-31A
Township/Range:	Coordinate X: 1255182.02
Logged By: T. Fowler	Coordinate Y: 219362.81
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 07/08/08

Remarks:

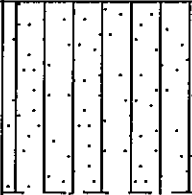
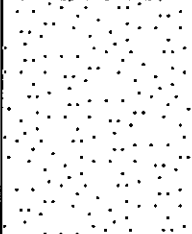
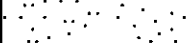
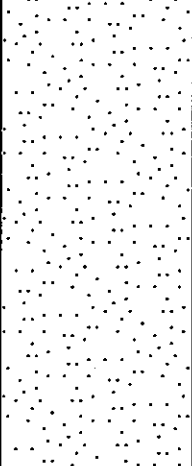
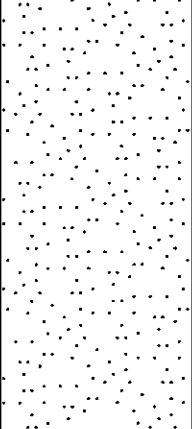
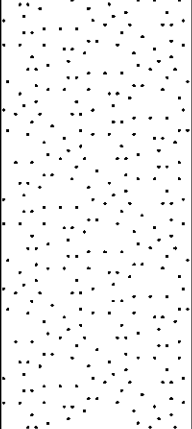
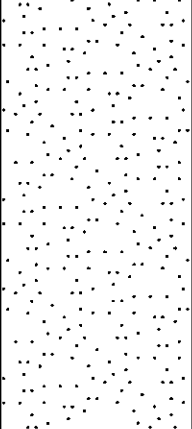
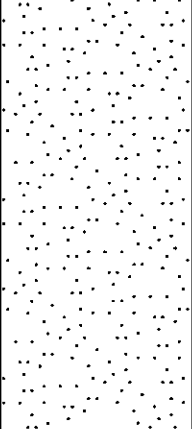
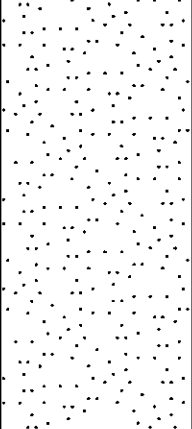
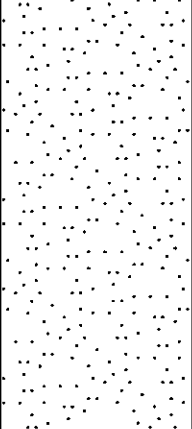
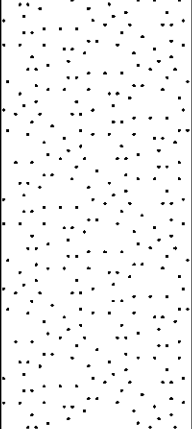
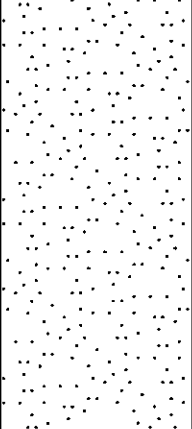
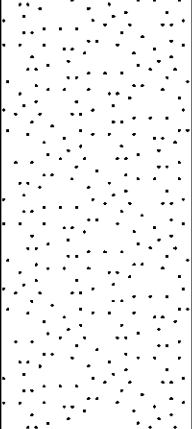
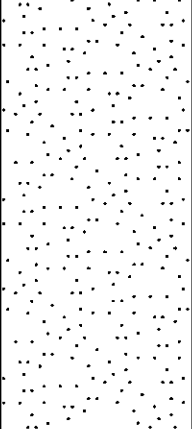
Date Completed: 07/08/08

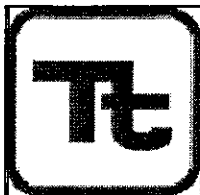
Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-32
Township/Range: Patchogue, New York	Coordinate X: 1255162.10
Logged By: Tom Fowler	Coordinate Y: 219365.88
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
	Date Completed: 01/29/08

Remarks:

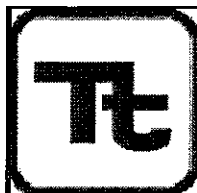
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
1	66	SM		0-2: Dark Gray to Gray Brown fine to medium SAND and silt, very moist	01/29/08	0 ppm	Slight odor PASB32-0-2 Full TCL
2				2-4.5: Medium Brown to Orange Brown fine to coarse SAND, little gravel, wet at 3' bgs	01/29/08	0 ppm	PASB32-2-4 Full TCL
3				4.5-5: Light Orange Brown fine to coarse SAND, medium density	01/29/08	0 ppm	PASB32-6-10 Full TCL
4				5-10: Light Gray Brown fine to coarse SAND, medium density, wet		0 ppm	
5	44			10-15: Light Gray fine to medium SAND, medium density, wet		0 ppm	
6		SP				0 ppm	
7					01/29/08	0 ppm	
8						0 ppm	
9						0 ppm	
10	58					0 ppm	
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-32
Township/Range: Patchogue, New York	Coordinate X: 1255162.10
Logged By: Tom Fowler	Coordinate Y: 219365.88
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
	Date Completed: 01/29/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15-20: Gray Brown fine to coarse SAND, medium density, wet	01/29/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Light Gray fine to medium SAND, medium density, wet	01/29/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-33
Township/Range: Patchogue, New York	Coordinate X: 1255146.67
Logged By: Tom Fowler	Coordinate Y: 219346.27
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08

Remarks:

Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
66		FI		0-1: Dark Gray GRAVEL and silty sand	01/29/08		slight odor
1				1-3: Dark Gray Brown fine to medium SAND, little gravel, wet		0 ppm	1-3: slight odor
2						0 ppm	PASB33-1-3
3				3-5: Medium Brown to Gray Brown fine to medium SAND, trace gravel, medium density, wet		0 ppm	Full TCL
4						0 ppm	
5	56			5-10: Yellow Brown fine to coarse SAND, medium density, wet	01/29/08		
6						0 ppm	PASB33-6-10
7						0 ppm	Full TCL
8						0 ppm	
9						0 ppm	
10	66			10-15: Light Gray Brown fine to coarse SAND, medium density, wet	01/29/08		
11						0 ppm	
12						0 ppm	
13		SP				0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP

Site Id: PASB-33

Township/Range: Patchogue, New York

Coordinate X: 1255146.67

Logged By: Tom Fowler

Coordinate Y: 219346.27

Drilling Method: Geoprobe

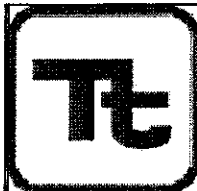
Total Depth: 25.00'

Date Started: 01/29/08

Remarks:

Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60			15-20: Light Gray Brown to Brown fine to medium SAND, grading to fine, medium density, wet	01/29/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	66			20-25: Light Gray Brown fine to medium SAND, medium density, wet	01/29/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-34
Township/Range: Patchogue, New York	Coordinate X: 1255181.54
Logged By: Tom Fowler	Coordinate Y: 219413.40
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
	Date Completed: 01/31/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60	FI		0-2: Whitish sand sized particles of broken concrete, some gravel	01/31/08	0.1 ppm	
1							
2				2-3.5: Dark Brown fine to coarse SAND and gravel, some silt			
3							
4		GM		3.5-5: Dark Brown fine to coarse SAND, moist			
5	80	SP		5-10: Gray Brown fine to coarse SAND, little gravel, medium density, wet	01/31/08	0.1 ppm	PASB34-10-15 Full TCL
6							
7							
8							
9							
10	40			10-15: Gray Brown to Light Gray Brown fine to medium SAND, medium density, wet	01/31/08	0 ppm	
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-34
Township/Range: Patchogue, New York	Coordinate X: 1255181.54
Logged By: Tom Fowler	Coordinate Y: 219413.40
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
	Date Completed: 01/31/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	48			15-20: Light Brown fine to coarse SAND, medium density, wet	01/31/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Light Brown fine to medium SAND, medium density, wet	01/31/08	0 ppm	
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

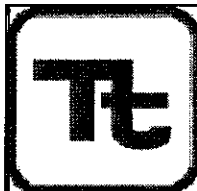


Project Name: Former Patchogue MGP	Site Id: PASB-35
Township/Range: Patchogue, New York	Coordinate X: 1255296.30
Logged By: Tom Fowler	Coordinate Y: 219218.32
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08

Remarks:

Date Completed: 02/04/08

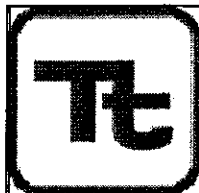
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0							
1		FI		0-2: Dark Gray silty SAND and gravel, dense	02/04/08	0 ppm	Hand augered to 5' bgs.
2							Hit refusal
3				2-5: Dark Brown fine to medium SAND, some silt, wet		0 ppm	the first 2 attempts.
4		SM				0 ppm	Third attempt was successful. Refusals were at 4.5' and 3.5' bgs, respectively.
5	56			5-7: Dark Brown fine to medium SAND, some fine peat strata	02/04/08	0 ppm	
6						0 ppm	
7				7-10: Gray Brown fine to coarse SAND, some gravel, wet		0 ppm	
8						0 ppm	
9						0 ppm	
10	30			10-15: Yellow Brown fine to coarse SAND, some gravel, medium density, wet	02/04/08	0 ppm	
11		SP				0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-35
Township/Range: Patchogue, New York	Coordinate X: 1255296.30
Logged By: Tom Fowler	Coordinate Y: 219218.32
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08
	Date Completed: 02/04/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	48	SM		15-20: Red Brown fine to coarse SAND, some dark brown peat strata, medium density, wet.	02/04/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	62			20-25: Yellow Brown fine to coarse SAND, medium density, wet	02/04/08	0 ppm	
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: PASB-36

Township/Range: Patchogue, New York

Coordinate X: 1255300.61

Logged By: Tom Fowler

Coordinate Y: 219269.70

Drilling Method: Geoprobe

Total Depth: 25.00'

Date Started: 02/05/08

Remarks:

Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0							
1				0-5: Gray Black fine to coarse SAND and silt, some gravel, little ash, trace tarry material	02/05/08	0 ppm	Hand augered to 5' bgs.
2						0 ppm	
3		FI				0 ppm	
4						0 ppm	
5	62	PT		5-5.5: Dark Brown PEAT	02/05/08		
6				5.5-6: Dark Gray Brown GRAVEL and fine to medium SAND, oily appearance		0.2 ppm	5.5-6: Slight odor PASB36-6-8
7				6-10: Gray Brown fine to medium SAND, medium density, wet			Full TCL
8		GM					7-8: Brown peat
9							
10	56			10-15: Orange Brown fine to coarse SAND, some gravel, medium density, wet	02/05/08		
11						0 ppm	PASB36-11-13
12						0 ppm	Full TCL
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP

Site Id: PASB-36

Township/Range: Patchogue, New York

Coordinate X: 1255300.61

Logged By: Tom Fowler

Coordinate Y: 219269.70

Drilling Method: Geoprobe

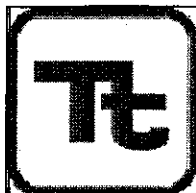
Total Depth: 25.00'

Date Started: 02/05/08

Remarks:

Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	42	SP		15-20: Yellow Brown fine to medium SAND, medium density, wet	02/05/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	28			20-25: Orange Brown fine to coarse SAND, trace gravel, medium density, wet	02/05/08	0 ppm	
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

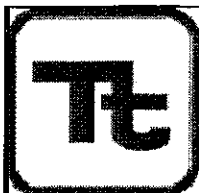


Project Name: Former Patchogue MGP	Site Id: PASB-37
Township/Range: Patchogue, New York	Coordinate X: 1255286.29
Logged By: Tom Fowler	Coordinate Y: 219332.80
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08

Remarks:

Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0							
1				0-5: Gray Black fine to coarse SAND and silt, some gravel, possible fly ash, slight oily appearance	02/05/08	0 ppm	Hand augered to 5' bgs.
2						0 ppm	
3		FI				0 ppm	
4						0 ppm	
5	66			5-6.5: Dark Gray Brown fine to coarse SAND and gravel, some silt, dense, wet	02/05/08		PASB37-5-7 Full TCL
6		GM				0 ppm	
7		SP		6.5-7.5: Dark Gray Brown fine to coarse SAND		0 ppm	
8		PT		7.5-8: Brown PEAT		0 ppm	
9				8-9: Brown fine to medium SAND, some peat near top		0 ppm	
10	66	SM		9-10: Dark Brown fine to medium SAND and peat		0 ppm	
11				10-15: Dark Brown fine to coarse SAND, medium density, wet. 10-10.5 SAND and gravel	02/05/08		
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-37
Township/Range: Patchogue, New York	Coordinate X: 1255286.29
Logged By: Tom Fowler	Coordinate Y: 219332.80
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08
	Date Completed: 02/05/08

Remarks:

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60	SP		15-20: Red Brown to Orange Brown fine to coarse SAND, medium density, wet	02/05/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	52			20-25: Yellow Brown to Red Brown fine to coarse SAND, medium density, wet	02/05/08	0 ppm	
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: PASB-38

Township/Range: Patchogue, New York

Coordinate X: 1255283.36

Logged By: Tom Fowler

Coordinate Y: 219408.41

Drilling Method: Geoprobe

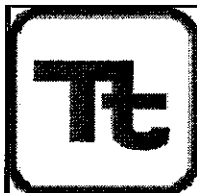
Total Depth: 25.00'

Date Started: 02/05/08

Remarks:

Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0				0-3: Dark Brown silty SAND, some gravel	02/05/08		Hand augered to 5' bgs.
1						0 ppm	
2		SM				0 ppm	
3				3-5: Gray Brown silty SAND, some gravel		0 ppm	
4						0 ppm	
5	56			5-6: Brown PEAT	02/05/08		PASB38-5-7
		PT					Full TCL
6				6-8: Dark Brown to Brown fine to coarse SAND, some gravel, some peat, wet		0 ppm	
7		GM				0 ppm	
8				8-10: Brown to Dark Brown fine to coarse SAND, little gravel, medium density, wet		0 ppm	
9						0 ppm	
10	52			10-11: Brown fine to coarse SAND, little gravel	02/05/08		
11				11-15: Gray Brown fine to medium SAND, medium density, wet		0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	

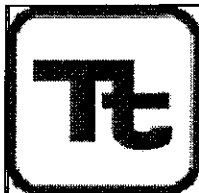


Project Name: Former Patchogue MGP	Site Id: PASB-38
Township/Range: Patchogue, New York	Coordinate X: 1255283.36
Logged By: Tom Fowler	Coordinate Y: 219408.41
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08

Remarks:

Date Completed: 02/05/08

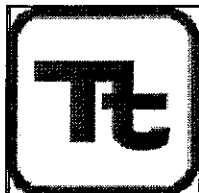
Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	50	SP		15-20: Gray Brown fine to coarse SAND, medium density, wet	02/05/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	42			20-25: Light Brown fine to medium SAND, medium density, wet	02/05/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-39
Township/Range:	Coordinate X: 1255314.26
Logged By: T. Fowler	Coordinate Y: 219376.97
Drilling Method: Geoprobe	Total Depth: 24.00'
	Date Started: 07/09/08
	Date Completed: 07/09/08

Remarks:

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	100	SP		0-4: Dark grey brown fine to medium SAND, some silt, wet at 4 feet	07/09/08		0-4: Hand augered
2							
3							
4	50	SP		4-5: Dark grey brown fine to coarse SAND, little gravel, wet	07/09/08	0 ppm	PASB39-4-9:
5		SM		5-5.5: Dark brown fine SAND, some silt, wet	07/09/08	0 ppm	VOC, SVOC,
6		SP		5.5-9: Dark brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	CN, TOC
7						0 ppm	
8						0 ppm	
9	16	GP		9-10: Light brown fine to coarse GRAVEL and fine to coarse SAND, medium dense, wet	07/09/08	0 ppm	
10						0 ppm	
11							
12							
13							
14	58			14-17: Dark grey brown fine to coarse SAND,	07/09/08	0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-39
Township/Range:	Coordinate X: 1255314.26
Logged By: T. Fowler	Coordinate Y: 219376.97
Drilling Method: Geoprobe	Total Depth: 24.00'
	Date Started: 07/09/08

Remarks:

Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	40	SM		some silt, some gravel, little peat, medium dense, wet	07/09/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20		PT		17-18: Dark brown PEAT, wet	07/09/08		
21							
22							
23							
24							
25		SP		18-19: Brown fine to coarse SAND, some gravel, wet	07/09/08		
26							
27				19-24: Orange brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
28						0 ppm	
29						0 ppm	
30		SP				0 ppm	
31						0 ppm	
32						0 ppm	
33						0 ppm	
34						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-40
Township/Range:	Coordinate X: 1255303.37
Logged By: T. Fowler	Coordinate Y: 219328.40
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/10/08

Remarks:

Date Completed: 07/10/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	100	SM		0-5: Dark grey fine to medium SAND and SILT, little gravel, moist	07/10/08		0-5: Hand augered. Water Table ~0.8 feet bgs in borehole PASB40-0-5: VOC, SVOC, CN, TOC
2							
3							
4							
5	50	SP		5-5.6: Dark brown, fine to coarse SAND, some gravel, little silt, wet	07/10/08	0 ppm	
6		PT		5.6-6.2: Dark brown PEAT, wet	07/10/08	0 ppm	
7		GP		6.2-7: Dark brown GRAVEL and fine to coarse SAND, wet	07/10/08	0 ppm	
8		SM		7-9.2: Dark brown fine to medium SAND, some peat, wet	07/10/08	0 ppm	
9						0 ppm	
10	64	SP		9.2-10: Dark brown fine to coarse SAND, some gravel, wet	07/10/08	0 ppm	
11		SP		10-12: Brown fine to coarse SAND, some gravel, wet	07/10/08	0 ppm	
12						0 ppm	
13		SP		12-15: Light brown fine to medium SAND, medium dense, wet	07/10/08	0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-40
Township/Range:	Coordinate X: 1255303.37
Logged By: T. Fowler	Coordinate Y: 219328.40
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/10/08
	Date Completed: 07/10/08

Remarks:

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	70	SP		15-20: Light brown, fine to medium SAND, trace gravel, medium dense, wet	07/10/08	0 ppm	PASB40-15-17: VOC, SVOC, CN, TOC
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	22	SP		20-25: Brown fine to medium SAND, trace gravel, medium dense, wet	07/10/08	0 ppm	20.8: dark red brown staining
21						0 ppm	
22						0 ppm	
23							
24							
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-41
Township/Range:	Coordinate X: 1255319.48
Logged By: T. Fowler	Coordinate Y: 219262.75
Drilling Method: Geoprobe	Total Depth: 30.00'
	Date Started: 07/09/08

Remarks:

Date Completed: 07/09/08

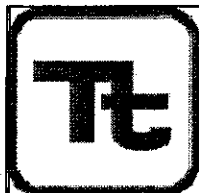
Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	100	SM		0-2: Dark grey SAND and SILT, little gravel, moist	07/09/08		0-5: Hand augered 0-2: slight fuel-like odor
2				2-5: Light grey brown to dark grey SILT, some sand, little gravel, appears to be osh, wet	07/09/08		
3		ML					
4				5-6: Dark brown PEAT, wet	07/09/08	5 ppm	
5	64	PT					
6		GP		6-6.5: Dark brown to black GRAVEL, wet	07/09/08		6-6.5: saturated with oil
7				6.5-8.5: Brown fine to medium SAND, some peat, wet	07/09/08	10 ppm	6.5-8: black staining
8		SP				8 ppm	
9				8.5-10: Light brown GRAVEL and fine to coarse SAND, wet	07/09/08	4 ppm	8-8.5: oil coated
10	58	GP				0.5 ppm	PASB-41-6-8: VOC, SVOC, CN, TOC
11		SP		10-11: Yellow brown fine to coarse SAND, medium dense, wet	07/09/08	0 ppm	
12				11-12.5: Orange brown and reddish brown laminations of fine SAND, wet	07/09/08	0 ppm	PASB-41-11-13: VOC, SVOC, CN, TOC
13		SP				0 ppm	
14				12.5-15: Dark brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-41
Township/Range:	Coordinate X: 1255319.48
Logged By: T. Fowler	Coordinate Y: 219262.75
Drilling Method: Geoprobe	Total Depth: 30.00'
	Date Started: 07/09/08
	Date Completed: 07/09/08

Remarks:

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	62	SP		15-16.5: Orange brown laminated fine to medium SAND, medium dense, wet	07/09/08	0 ppm	18.2-18.5: dark brown staining
16						0 ppm	
17				16.5-18.2: Light brown fine SAND, little gravel, medium dense, wet	07/09/08	0 ppm	
18		SP		18.2-18.5: Dark brown fine SAND, wet	07/09/08	0 ppm	
19				18.5-20: Orange brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
20	62	SP		20-25: Orange brown and red brown laminated fine to medium SAND, wet	07/09/08	0 ppm	
21						0 ppm	
22				21.4-21.7: Dark brown fine SAND, wet		0 ppm	
23				21.7-25: Orange brown and red brown laminated fine to medium SAND, wet		0 ppm	
24						0 ppm	
25	58	SP		25-30: Yellow brown fine to medium SAND, wet	07/09/08	0 ppm	
26						0 ppm	
27						0 ppm	
28						0 ppm	

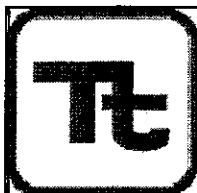


Project Name: Former Patchogue MGP	Site Id: PASB-41
Township/Range:	Coordinate X: 1255319.48
Logged By: T. Fowler	Coordinate Y: 219262.75
Drilling Method: Geoprobe	Total Depth: 30.00'
	Date Started: 07/09/08

Remarks:

Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
29							29-29.2: dark brown staining
30							29.5: black staining
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							



Project Name: Former Patchogue MGP	Site Id: PASB-42
Township/Range:	Coordinate X: 1255156.06
Logged By: T. Fowler	Coordinate Y: 219305.00
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/08/08

Remarks:

Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	68	SM		0-1: Dark grey silty SAND	07/08/08	0 ppm	PASB-42-0-0.2
		FI		1-1.5: Weathered concrete and gravel, some silt, moist	07/08/08	0 ppm	and PASB-42-0-0.5:
2		FI		1.5-2: Weathered dark brown wood fragments	07/08/08	0 ppm	VOC, SVOC,
		SM		2-3: Dark brown silty SAND, some gravel, peat lens	07/08/08	0 ppm	CN, TOC
3						0 ppm	
		FI		3-3.8: Dark brown silty SAND, brick and concrete fragments	07/08/08	0 ppm	
4							
		FI		3.8-4.2: Dark brown to black organic silt, wood shavings, wet	07/08/08		3.8-4.2: black
							staining
		FI		4.2-5: Dark brown silty SAND, brick and concrete fragments, wet	07/08/08		
5	58						
		SP		5-7: Orange brown fine to coarse SAND, some gravel, medium dense to dense, red brown color from 6.5 to 7 feet	07/08/08	0 ppm	
6						0 ppm	
						0 ppm	
7						0 ppm	
		SP		7-10: Yellow brown fine to medium SAND, medium dense, wet	07/08/08	0 ppm	
8						0 ppm	
9							
10	46						
		SP		10-15: Light grey brown fine to medium SAND, trace gravel, wet	07/08/08	0 ppm	
11						0 ppm	
						0 ppm	
12						0 ppm	
13							13-13.1: brown
							staining
14							

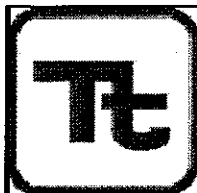


Project Name: Former Patchogue MGP	Site Id: PASB-42
Township/Range:	Coordinate X: 1255156.06
Logged By: T. Fowler	Coordinate Y: 219305.00
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/08/08

Remarks:

Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	48	SP		15-20: Grey brown fine to medium SAND, medium dense, wet	07/08/08		
16							
17							
18							
19		SP		20-25: Light brown fine to medium SAND, medium dense, wet	07/08/08	0 ppm 0 ppm 0 ppm 0 ppm 0 ppm 0 ppm	PASB-42-23-25: VOC, SVOC, CN, TOC
20	52						
21							
22							
23							
24							
25							
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-43
Township/Range:	Coordinate X: 1255146.17
Logged By: T. Fowler	Coordinate Y: 219281.14
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/08/08

Remarks:

Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	60	SP		0-2: Dark brown silty SAND, some gravel	07/08/08	0 ppm	PASB-43-0-0.2 and PASB-43-0-0.5: VOC, SVOC
2		FI		2-3: Brown silty SAND, brick and concrete fragments	07/08/08	0 ppm	
3		FI		3-5: Brown silty SAND, brick fragments, wet	07/08/08	0 ppm	
4		FI					
5	40	SM		5-6.5: Brown fine to medium silty SAND, little gravel, wet	07/08/08	0 ppm	11: dark brown staining
6		SM					
7		SM					
8		SM					
9		SP		6.5-10: Fine to medium SAND, medium dense, wet	07/08/08	0 ppm	PASB-43-13-15: VOC, SVOC CN, TOC
10	52	SP		10-15: Light grey brown fine to coarse SAND, little gravel, medium dense, wet	07/08/08	0 ppm	
11		SP					
12		SP					
13		SP					
14		SP					

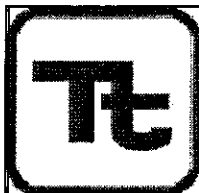


Project Name: Former Patchogue MGP	Site Id: PASB-43
Township/Range:	Coordinate X: 1255146.17
Logged By: T. Fowler	Coordinate Y: 219281.14
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/08/08

Remarks:

Date Completed: 07/08/08

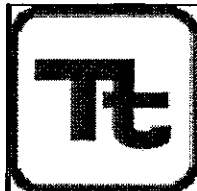
Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	64	SP		15-20: Light brown fine to medium SAND, medium dense, wet	07/08/08	0 ppm	14.0-14.3: dark brown staining
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	36	SP		20-25: Light brown to orange brown fine to coarse SAND, wet	07/08/08	0 ppm	19.0-19.1: brown staining
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							PASB-43-23-25: VOC, SVOC, CN, TOC
26							
27							
28							



Project Name: Former Patchogue MGP	Site Id: PASB-44
Township/Range:	Coordinate X: 1255344.89
Logged By: T. Fowler	Coordinate Y: 219245.82
Drilling Method: Geoprobe	Total Depth: 14.00'
	Date Started: 07/09/08
	Date Completed: 07/09/08

Remarks:

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	100	SP		0-4: Grey brown silty SAND, wet at 4 feet bgs	07/09/08		0-4: Hand augered Slight petroleum-like odor
2							
3							
4	66	SP		4-6: Brown to grey brown fine to medium SAND, medium dense, very thin 30-degree dark brown strata at at 5 feet bgs, wet	07/09/08	0 ppm	
5						0 ppm	
6						0 ppm	
7		SP		6-6.5: Dark grey fine to medium SAND, wet	07/09/08	0 ppm	
8				6.5-9: Light grey brown fine to medium SAND, some gravel, wet	07/09/08	0 ppm	
9						0 ppm	
10	62	SP		9-11: Brown fine to coarse SAND, some gravel, wet	07/09/08	0 ppm	7.5-8: dark brown to black staining PASB44-7-9: VOC, SVOC, CN, TOC
11						0 ppm	
12						0 ppm	
13		SP		11-14: Yellow brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-45
Township/Range:	Coordinate X: 1255361.55
Logged By: T. Fowler	Coordinate Y: 219233.32
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 07/09/08

Remarks:

Date Completed: 07/09/08

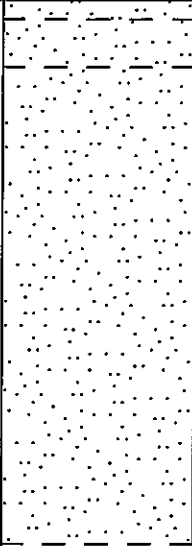
Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	100	SP		0-5: silty SAND	07/09/08		0-5: Hand ougered
2							
3							
4							
5	62	SP		5-7: Dark grey brown to black silty SAND, some gravel, grading to peat, wet	07/09/08	0 ppm	PASB45-5-7:
6						0 ppm	VOC, SVOC,
7						0 ppm	CN, TOC
8						0 ppm	5-7: block
9		SP		7-10: Grey brown fine to medium SAND, some gravel, wet	07/09/08	0 ppm	stoining
10						0 ppm	
11						0 ppm	
12						0 ppm	
13		SP		10-11: Red brown coarse SAND, wet	07/09/08	0 ppm	
14	78					0 ppm	
15						0 ppm	
16						0 ppm	
17		SP		11-14: Yellow brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
18						0 ppm	
19						0 ppm	
20						0 ppm	
21		SP		14-14.5: Red brown coarse SAND, wet	07/09/08	0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	

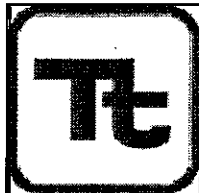


Project Name: Former Patchogue MGP	Site Id: PASB-45
Township/Range:	Coordinate X: 1255361.55
Logged By: T. Fowler	Coordinate Y: 219233.32
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 07/09/08

Remarks:

Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	64	SP		14.5-15: Yellow brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
16				15-20: Reddish brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
17						0 ppm	
18		SP				0 ppm	
19						0 ppm	
20						0 ppm	
21							
22							
23							
24							
25							
26							
27							
28							

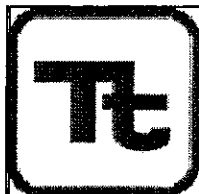


Project Name: Former Patchogue MGP	Site Id: PASB-46
Township/Range:	Coordinate X: 1255152.27
Logged By: T. Fowler	Coordinate Y: 219210.17
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/10/08

Remarks:

Date Completed: 07/10/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
50					07/10/08	0 ppm	
1		SP		0-1.5: Dark grey SAND, some silt, brick fragments, moist		0 ppm	PASB-46-0-0.2 and
2				1.5-3: Grey brown fine to coarse SAND, some silt, wet	07/10/08	0 ppm	PASB-46-0-0.5:
3						0 ppm	VOC, SVOC,
4		SP		3-5: Dark grey brown fine to medium SAND, little silt, trace gravel, medium dense, wet	07/10/08	0 ppm	CN, TOC
5	82						
6		SP		5-7: Grey brown to dark brown fine to medium SAND, little peat, wet	07/10/08	0 ppm	
7		PT		7-7.4: Brown PEAT, some sand, wet	07/10/08	0 ppm	PASB46-6-8:
8				7.4-9.6: Brown fine to medium SAND, medium dense, peat lenses at 7.5 to 7.7 feet bgs, 8.5 to 8.8 feet bgs, and 9.2 to 9.3 feet bgs, wet	07/10/08	0 ppm	VOC, SVOC,
9		SP				0 ppm	CN, TOC
10	66	PT		9.6-10: Brown PEAT, wet	07/10/08	0 ppm	
11		SP		10-11.5: Light brown fine to coarse SAND, some gravel, medium dense, wet	07/10/08	0 ppm	
12						0 ppm	
13		SP		11.5-15: Light brown fine to medium SAND, medium dense, wet	07/10/08	0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-46
Township/Range:	Coordinate X: 1255152.27
Logged By: T. Fowler	Coordinate Y: 219210.17
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/10/08

Remarks:

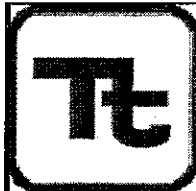
Date Completed: 07/10/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	58	SP		15-20: Light brown fine to medium SAND, medium dense, wet	07/10/08	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	30	SP		20-25: Light brown fine to medium SAND, medium dense, wet	07/10/08	0 ppm	
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

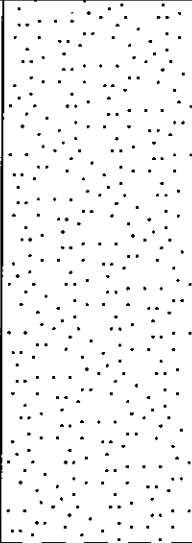


Project Name: Former Patchogue MGP	Site Id: PASB-47
Township/Range:	Coordinate X: 1255436.87
Logged By: C. DeCarlo	Coordinate Y: 219236.43
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 11/23/09
	Date Completed: 11/23/09
Remarks: Due to moisture, the PID was not functioning properly for the end of this boring.	

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
0	46	ML		0-1.6: Dark grayish brown SILT, with some medium Sand, and shell fragments.	11/23/2009	0 ppm	Petroleum-like odor present.
1				1.6-4.8: Black SILT with trace medium Sand and organic plant material, wet at 2.5 feet.	11/23/2009	0 ppm	
2						50.5 ppm	
3							
4		SP		4.8-5: Dark brown f SAND, wet.		7.1 ppm	
5	44			5-6.3: Dark brown f SAND, wet.	11/23/2009	2.5 ppm	
6						1.9 ppm	
7		GW		6.3-10: Dark brown f-c GRAVEL, wet.	11/23/2009	2.7 ppm	
8							
9							
10	70			10-15: Yellowish red f SAND, red mottling, wet.	11/23/2009		
11							
12							
13							
14							



Project Name: Former Patchogue MGP	Site Id: PASB-47
Township/Range:	Coordinate X: 1255436.87
Logged By: C. DeCarlo	Coordinate Y: 219236.43
Drilling Method: Geoprobe	Total Depth: 20.00'
Remarks: Due to moisture, the PID was not functioning properly for the end of this boring.	Date Started: 11/23/09
	Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	0	SP		15-20: Yellowish red f SAND, red mottling, wet.	11/23/2009		
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							



Project Name: Former Patchogue MGP

Site Id: PASB-48

Township/Range:

Coordinate X: 1255420.16

Logged By: C. DeCarlo

Coordinate Y: 219186.62

Drilling Method: Geoprobe

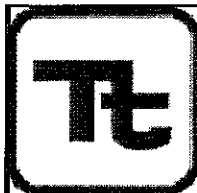
Total Depth: 20.00'

Date Started: 11/23/09

Remarks:

Date Completed: 11/23/09

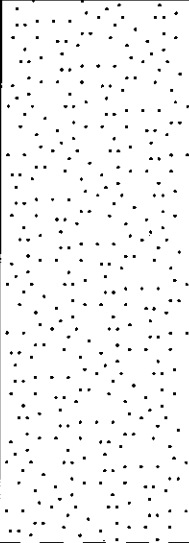
Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	64	ML		0-2.3: Dark reddish brown SILT, trace f Sand, with organic matter.		1 ppm	Petroleum-like odor present at 2.5 feet.
2				2.3-4: Dark reddish brown SILT, trace f Sand, with organic matter, Gravel and coal fragments, wet at 2.5 feet.	11/23/2009	0 ppm 30.5 ppm	
3							
4				4-5: Black f SAND with trace Gravel, wet.	11/23/2009	7.6 ppm	
5	100	SP		5-7.4: Dark reddish brown f SAND, trace Silt, wet.	11/23/2009	0 ppm	
6							
7							
8				7.4-9.3: Reddish brown f-c GRAVEL with f-c Sand, wet.	11/23/2009	0 ppm	
9		GW					
10	78			9.3-10: Reddish brown f SAND, wet.	11/23/2009	0 ppm	
11				10-13.5: Very pale brown f SAND, wet.	11/23/2009	0 ppm	
12						0 ppm	
13						0 ppm	
14				13.5-15: Yellowish red f SAND, with red mottling, wet.	11/23/2009	0 ppm	

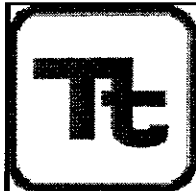


Project Name: Former Patchogue MGP	Site Id: PASB-48
Township/Range:	Coordinate X: 1255420.16
Logged By: C. DeCarlo	Coordinate Y: 219186.62
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 11/23/09

Remarks:

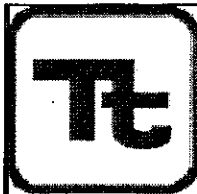
Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	64	SP		15-20: Yellowish red f SAND, with red mottling, wet.	11/23/2009	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20							
21							
22							
23							
24							
25							
26							
27							
28							



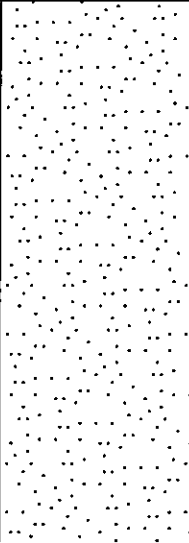
Project Name: Former Patchogue MGP	Site Id: PASB-49
Township/Range:	Coordinate X: 1255369.56
Logged By: C. DeCarlo	Coordinate Y: 219124.62
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 11/23/09
	Date Completed: 11/23/09
Remarks: Due to moisture, the PID was not functioning properly for the beginning of this boring.	

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	64	ML		0-2.1: Very dark grayish brown SILT trace Sand with cinder and shell fragments.			
2				2.1-4.6: Brown f SAND, wet at 2.5'.	11/23/2009		
3							
4		SP		4.6-5: Dark brown f SAND, trace Silt, wet.	11/23/2009		
5	90			5-7.1: Pale brown f SAND, trace gravel, wet.	11/23/2009		
6							
7				7.1-10: Yellowish brown f-c GRAVEL with c Sand, wet.	11/23/2009		
8		GW					
9							
10	62			10-11.7: Pale brown f SAND, wet.	11/23/2009	0 ppm	
11				11.7-15: Yellowish red f SAND with red banding, wet.	11/23/2009	0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	



Project Name: Former Patchogue MGP	Site Id: PASB-49
Township/Range:	Coordinate X: 1255369.56
Logged By: C. DeCarlo	Coordinate Y: 219124.62
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 11/23/09

Remarks: Due to moisture, the PID was not functioning properly for the beginning of this boring.	Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	68	SP		15-20: Yellowish red f SAND with red banding, wet.	11/23/2009	0 ppm	
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20							
21							
22							
23							
24							
25							
26							
27							
28							

TETRA TECH EC, INC. TEST PIT/TRENCH LOG

Project: Keyspan Patchogue
 Test Pit No.: 1
 Date: 7/7/08
 Geologist: Tom Fowler
 Pit Orientation: West-East

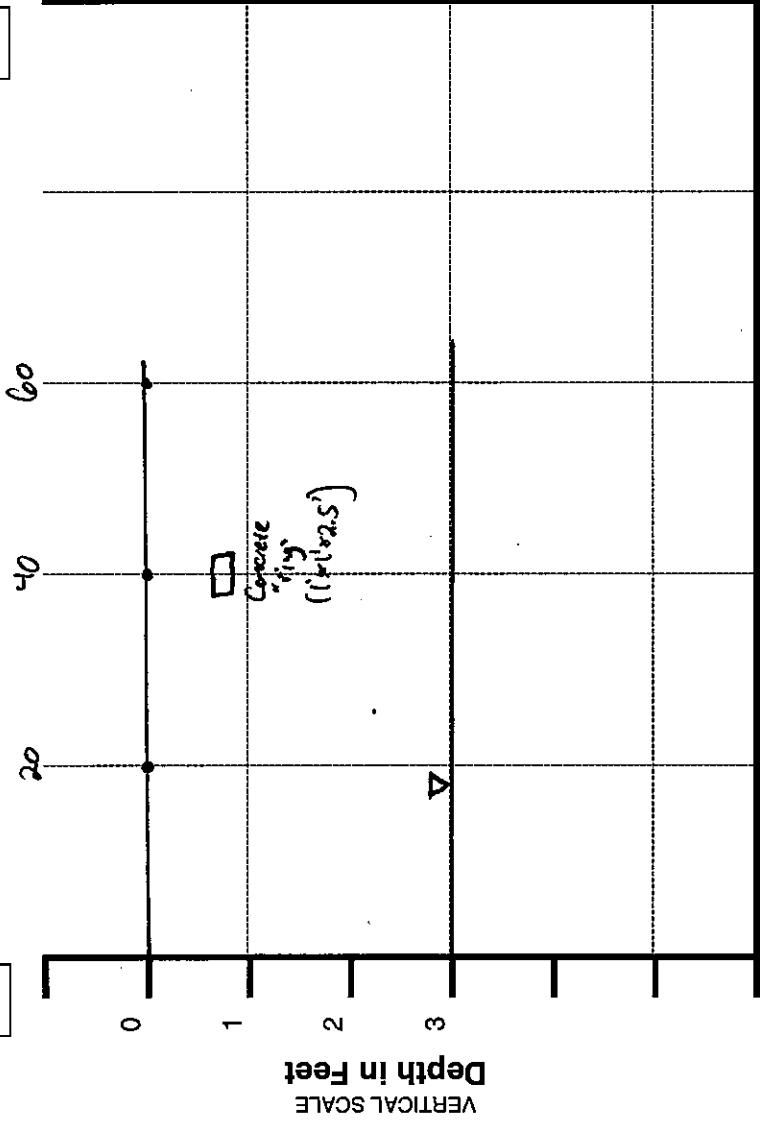
Start Time: 11:10
 Final Length: 60'
 Final Depth: 3'
 Final Width:

End Time: 13:40 Weather: 70 Cloudy and Humid
 Surface Conditions: Vegetated

W

E

Description of Material PID/
FID Sample
Taken



NOTES:

TETRA TECH EC, INC. TEST PIT/TRENCH LOG

Project: Keyspan Patchogue
 Test Pit No.: 2
 Date: 7/7/08
 Geologist: Tom Fowler
 Pit Orientation: Northeast-Southwest

Start Time: 14:15
 Final Length: 20'
 Final Depth: 3'
 Final Width:

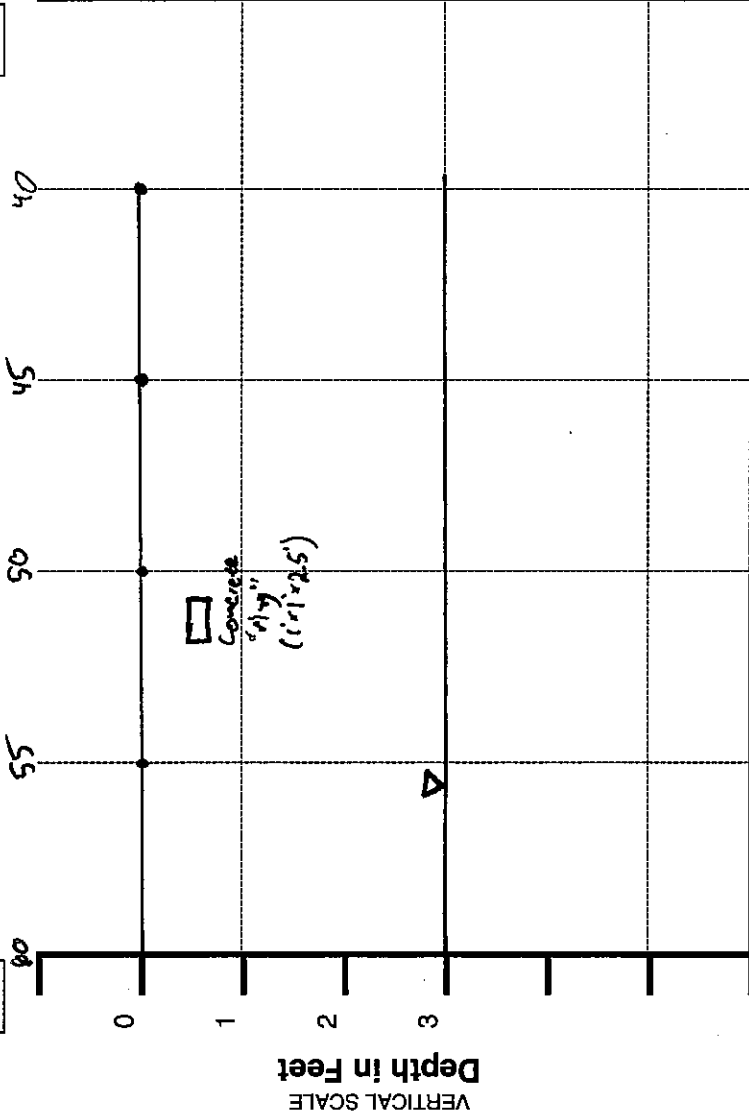
End Time: 15:10

Weather: 70 Cloudy and Humid
 Surface Conditions: Vegetated

S
W

NE

Description of Material
 PID/
 FID
 Sample
 Taken

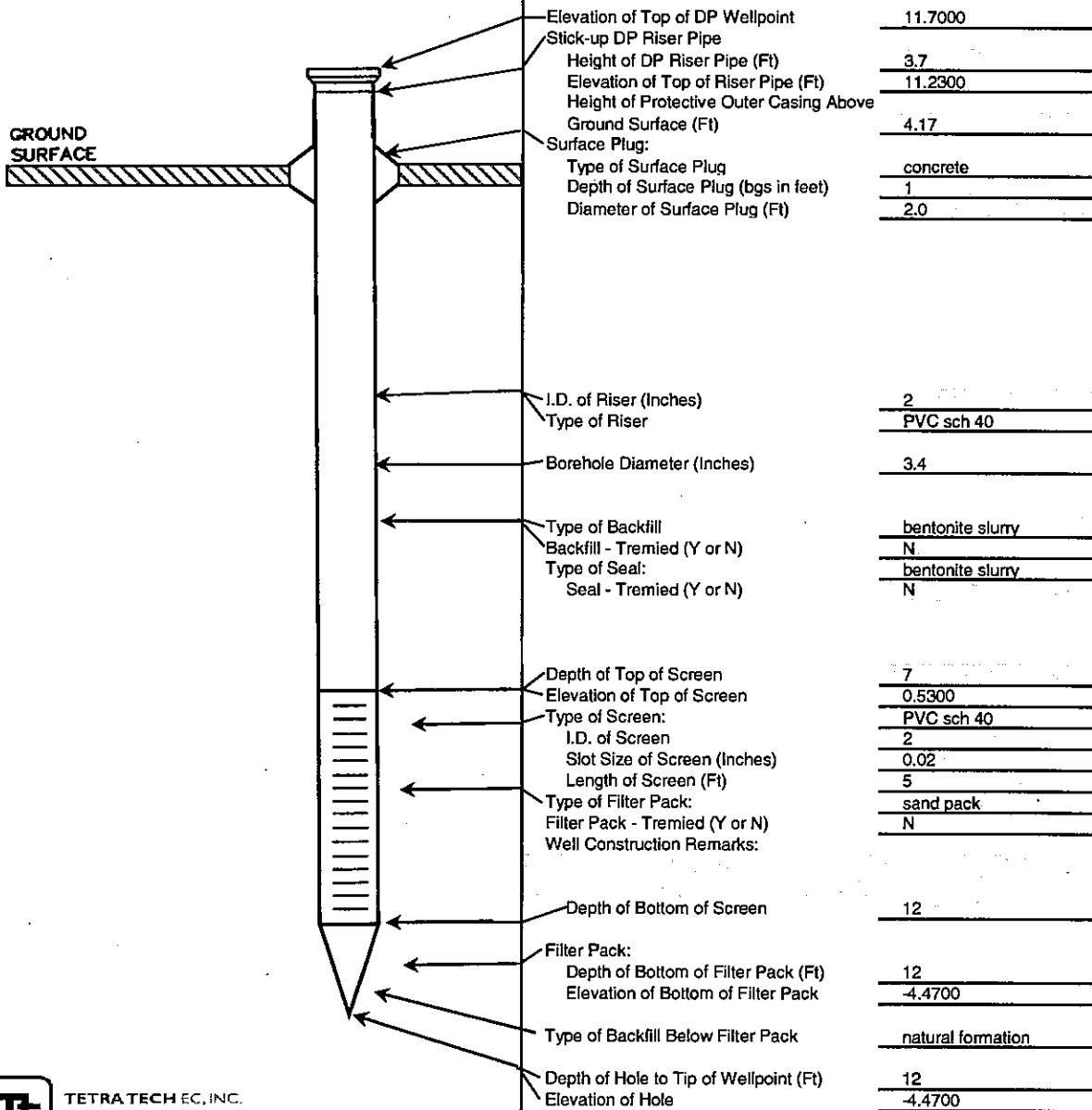


NOTES:

FT.
HORIZONTAL SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	WELL NUMBER:	MW-1
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-1
BORING NUMBER:	MW-1	DATE COMPLETED:	01/28/08
ELEVATION (FT):	11.2300	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255132.53800
DRILLER:	Zebra	Y COORDINATE:	219674.03000
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	7.53
SUMP INSTALLED?(Y/N):	N	SUMP LENGTH (FT):	
		METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used

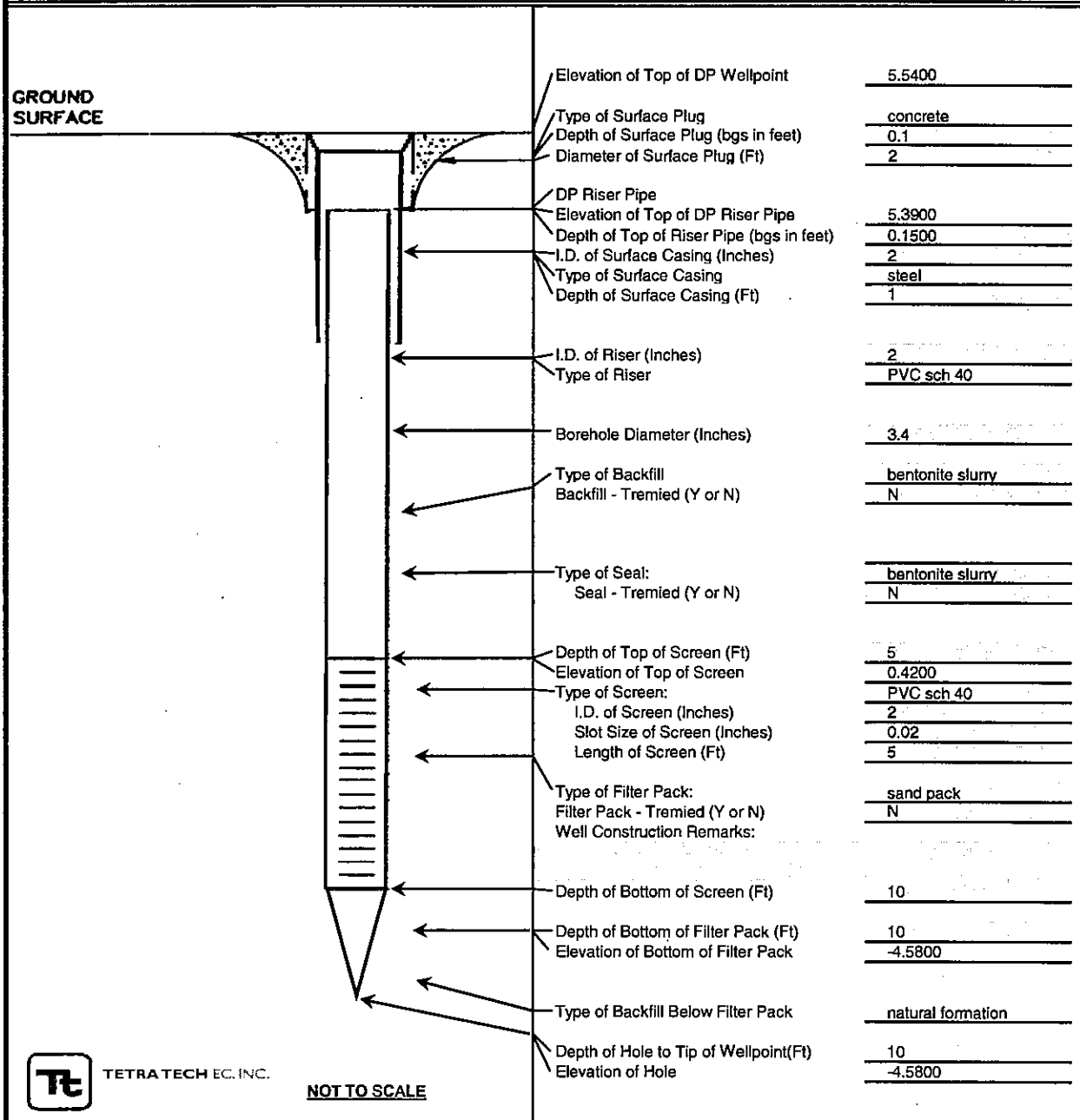


TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT: Patchogue Former MGP PROJECT NO.: 106-3599.0001.0030.00000 BORING NUMBER: MW-3 ELEVATION (FT): 5.3900 FIELD GEOLOGIST: Tom Fowler DRILLER: Zebra DRILLING METHOD: Direct Push DEVELOPMENT METHOD: Submersible Pump SUMP INSTALLED?(Y/N): N SUMP LENGTH (FT): 0	WELL NUMBER: MW-3 WELL LOCATION (STATION) ID: MW-3 DATE COMPLETED: 01/28/08 SURVEY DATE: X COORDINATE: 1255328.74200 Y COORDINATE: 219200.31200 DATUM: NAVD88 START DEPTH (FT): 5.42 METHOD TO MEASURE WELL DEPTH: Casing/screen used
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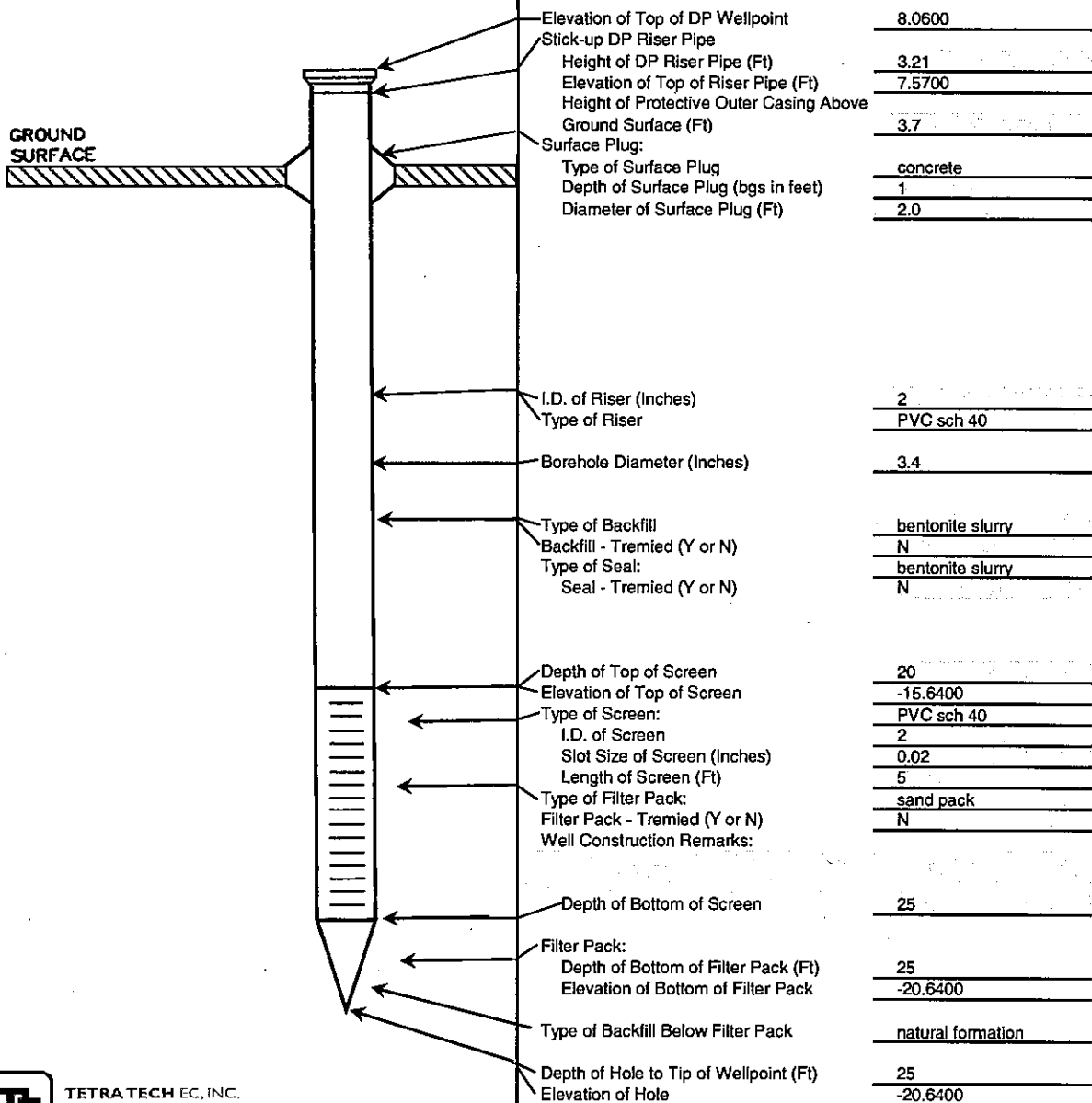


TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	WELL NUMBER:	MW-4D
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-4D
BORING NUMBER:	MW-4D	DATE COMPLETED:	01/28/08
ELEVATION (FT):	7.5700	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255291.58300
DRILLER:	Zebra	Y COORDINATE:	219134.53100
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.36
SUMP INSTALLED?(Y/N):	N	SUMP LENGTH (FT):	
		METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used

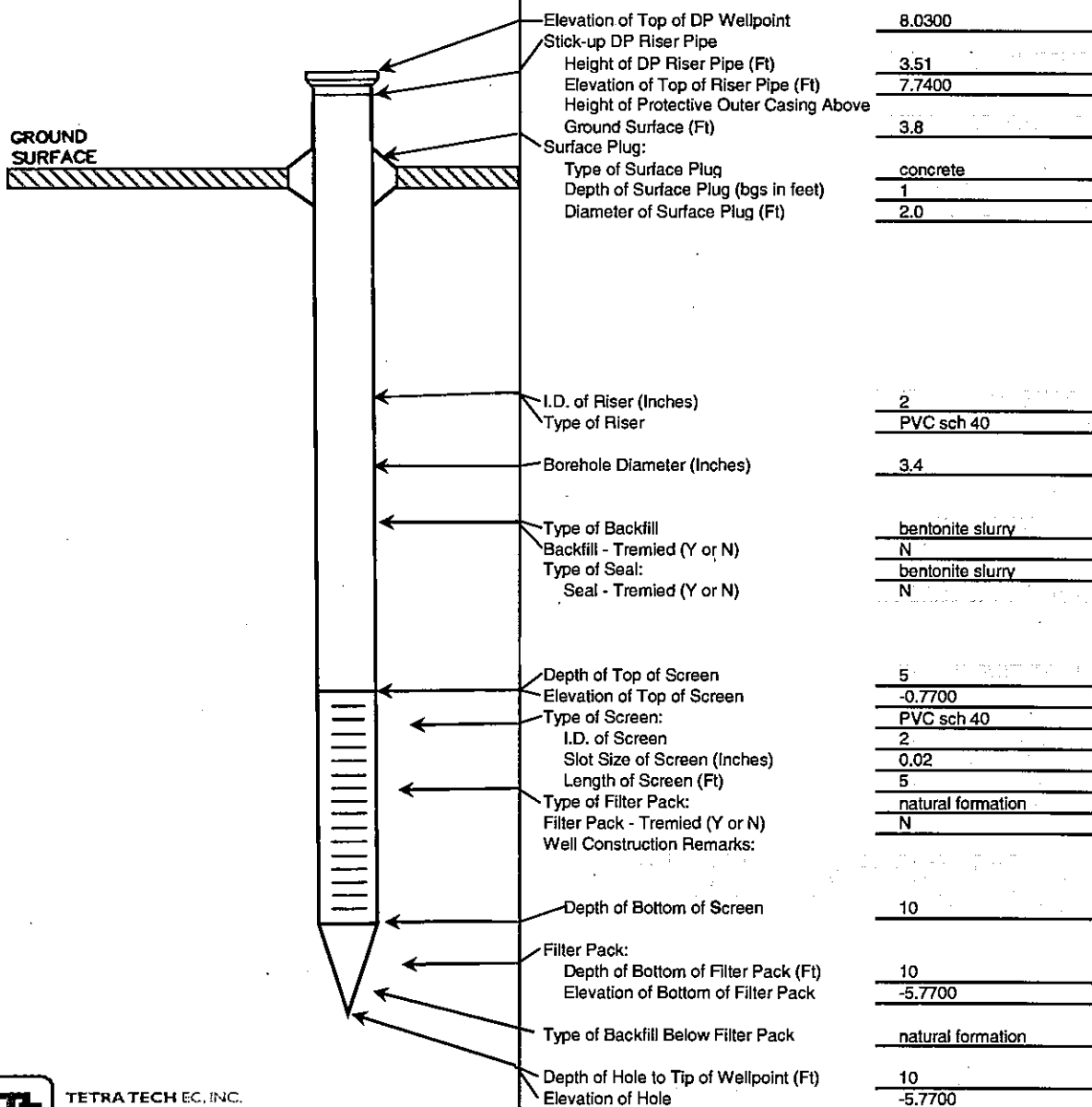


TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	WELL NUMBER:	MW-4S
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-4S
BORING NUMBER:	MW-4S	DATE COMPLETED:	01/28/08
ELEVATION (FT):	7.7400	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255290.45900
DRILLER:	Zebra	Y COORDINATE:	219131.47500
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.23
SUMP INSTALLED?(Y/N):	N	SUMP LENGTH (FT):	
		METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used

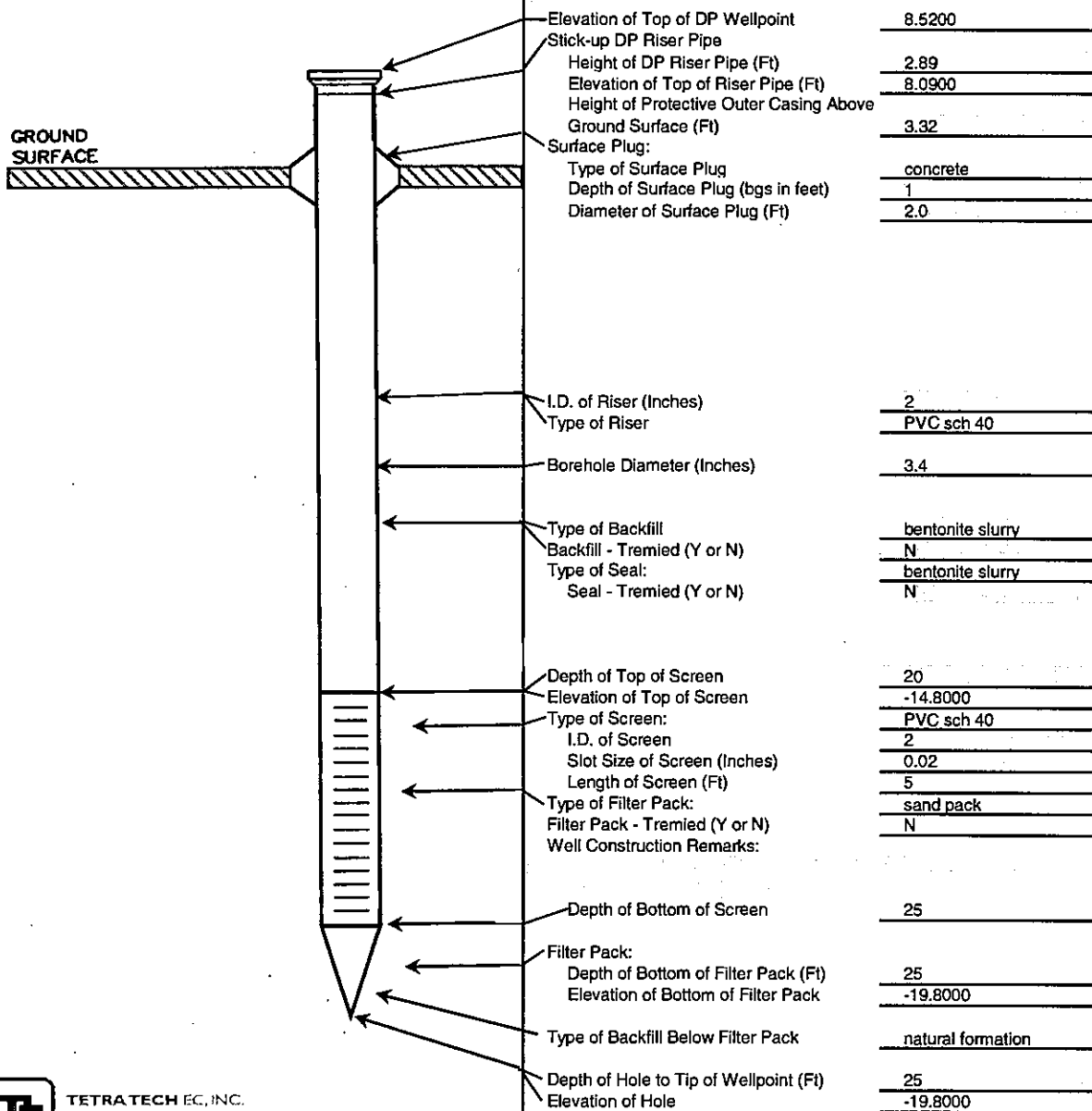


TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	WELL NUMBER:	MW-7D
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-7D
BORING NUMBER:	MW-7D	DATE COMPLETED:	07/10/08
ELEVATION (FT):	8.0900	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255151.94300
DRILLER:	Zebra	Y COORDINATE:	219210.17890
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.2
SUMP INSTALLED?(Y/N):	N	SUMP LENGTH (FT):	
		METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used

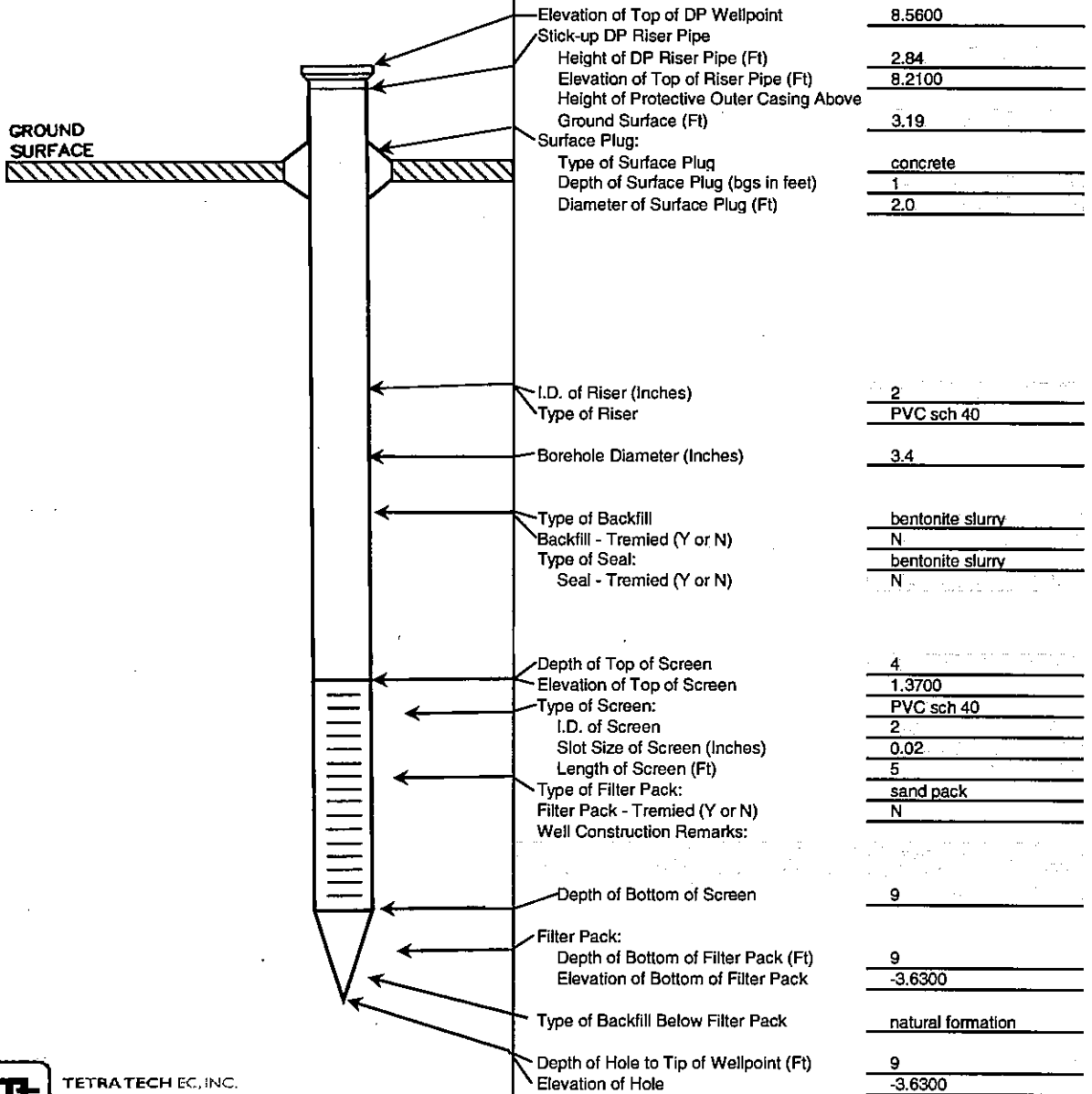


TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	WELL NUMBER:	MW-7S
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-7S
BORING NUMBER:	MW-7S	DATE COMPLETED:	07/10/08
ELEVATION (FT):	8.2100	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255153.29900
DRILLER:	Zebra	Y COORDINATE:	219212.04600
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.37
SUMP INSTALLED?(Y/N):	N	SUMP LENGTH (FT):	
		METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used

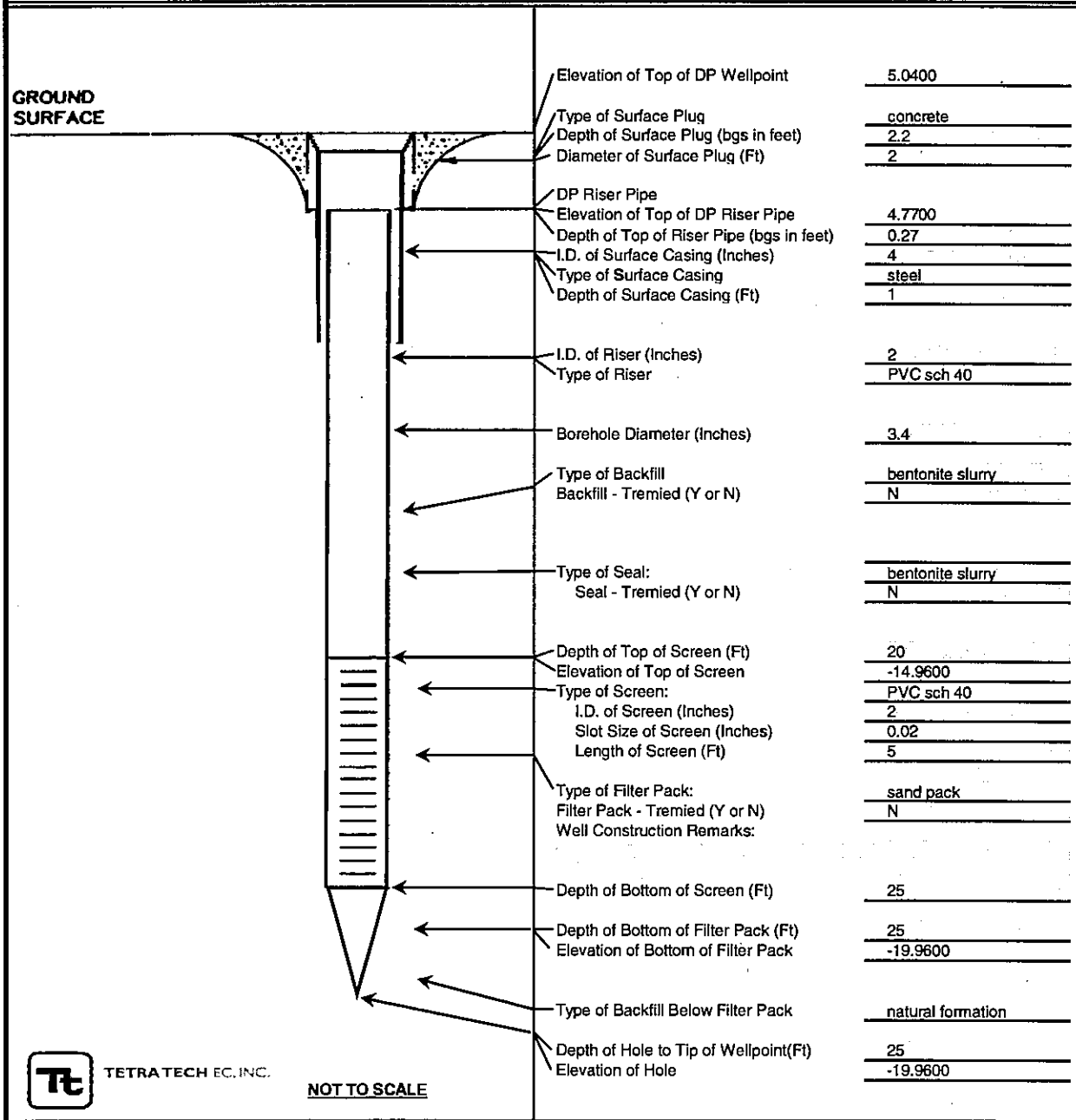


TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT:	Patchogue Former MGP	WELL NUMBER:	MW-8D
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-8D
BORING NUMBER:	MW-8D	DATE COMPLETED:	07/10/08
ELEVATION (FT):	4.7700	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255314.26700
DRILLER:	Zebra	Y COORDINATE:	219376.87200
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.04
SUMP INSTALLED?(Y/N):	N	SUMP LENGTH (FT):	0
		METHOD TO MEASURE WELL DEPTH:	Casing/screen used

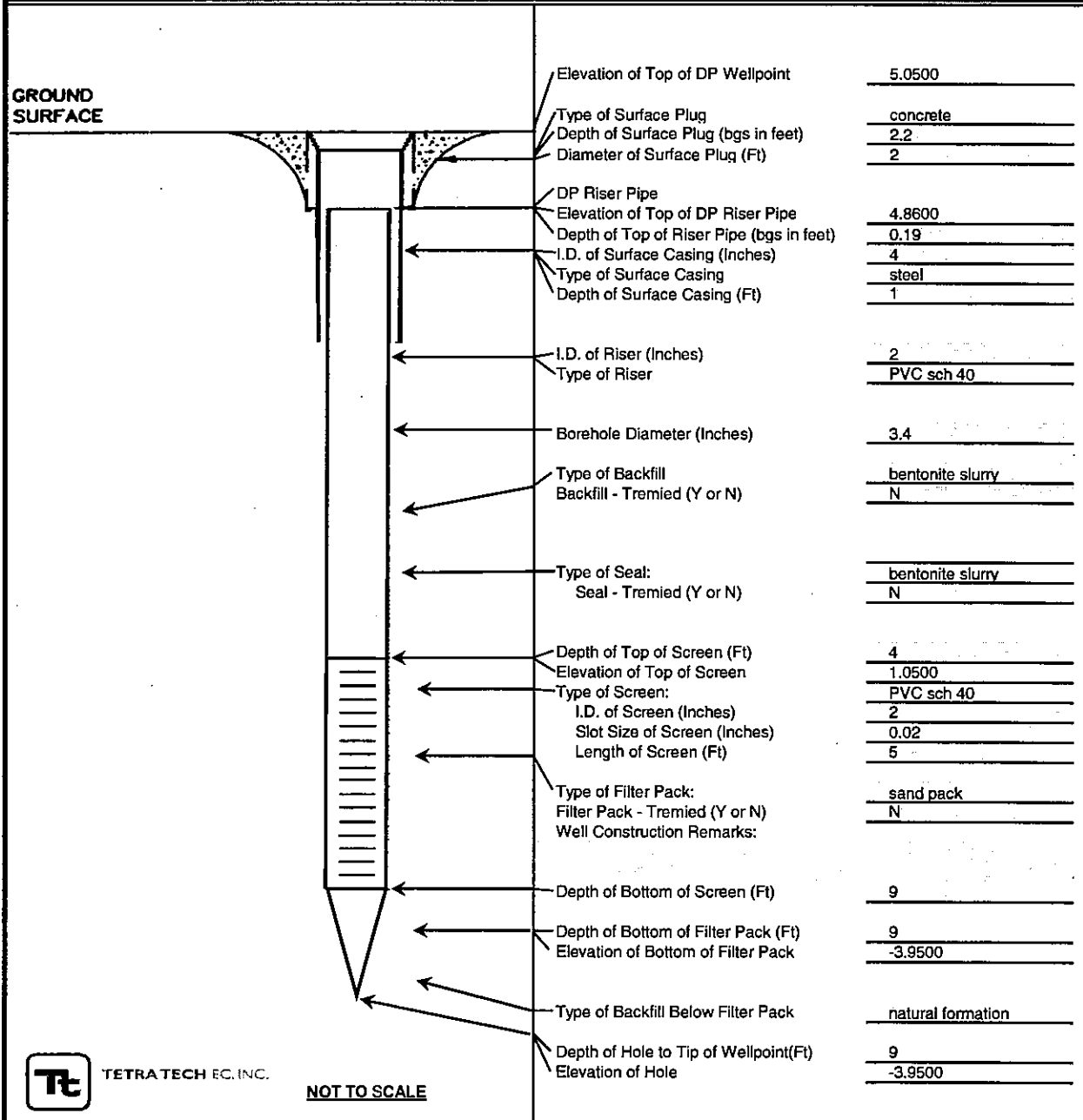


TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT: Patchogue Former MGP	WELL NUMBER: MW-8S
PROJECT NO.: 106-3599.0001.0030.00000	WELL LOCATION (STATION) ID: MW-8S
BORING NUMBER: MW-8S	DATE COMPLETED: 07/10/08
ELEVATION (FT): 4.8600	SURVEY DATE: 07/15/08
FIELD GEOLOGIST: Tom Fowler	X COORDINATE: 1255313.69000
DRILLER: Zebra	Y COORDINATE: 219375.89900
DRILLING METHOD: Direct Push	DATUM: NAVD88
DEVELOPMENT METHOD: Submersible Pump	START DEPTH (FT): 5.05
SUMP INSTALLED?(Y/N): N	SUMP LENGTH (FT): 0
	METHOD TO MEASURE WELL DEPTH: Casing/screen used



TETRA TECH EC, INC.

NOT TO SCALE

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-101
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/18/10 - 5/18/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.		Easting: 1255243.5 ft. Northing: 219389.2 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					0.4	Borehole backfilled with bentonite chips. 1.2-1.8' BGS: Black staining and slight tar-like odor.
		SP	Brown mfc SAND, trace Silt, trace Organics.								
		GP	Brown cmf SAND, little Gravel (Misc. Fill-brick, coal).								
		GP	Gray/Lt. Gray mfc SAND, little fc Gravel.								
		PT	ALLUVIAL DEPOSITS								
			ORGANICS (root material). Wet @ 3.3'								
5	0	SP	Gray/Brown mfc SAND, trace f Gravel.		2					0.4	
		GP	Dk. Brown SILT & CLAY.								
		OL	OUTWASH DEPOSITS								
		SP	Brown/Tan cmf SAND, little fmc Gravel (rounded). Wet to saturated @ 8.0'.								
		GP									
10	-5	SP	Tan/Lt. Brown mfc SAND, trace (+) fmc Gravel (rounded). Saturated.		3					0.4	
		GP									
15	-10	SP	Tan/Lt. Brown mfc SAND, trace (-) fm Gravel (rounded), trace Silt. Saturated.		4					0.2	
		GP									
20	-15										

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-102
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/18/10 - 5/18/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.		Easting: 1255259.4 ft. Northing: 219304.1 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					50.9	Borehole backfilled with bentonite chips. 2.2-2.5' BGS: Black staining, moderate to strong tar-like odor. 2.5-3.0' BGS: Slight to faint tar-like odor. 5.8' BGS: Slight tar-like odor. 6.2-6.5' BGS: Rainbow sheen on soil grains, slight NAPL coating on grains. Moderate to strong tar-like odor. 7.0-7.7' BGS: Black staining, moderate tar-like odor.
		SP	Dk. Brown fm SAND, little (+) Silt, trace Organics (topsoil).								
		GP	Gray/Brown fm SAND, some (-) Gravel (angular).								
		SP	Brown/Black/Tan cmf SAND, some (-) Gravel (Misc. Fill-coal, cinders). Moist.								
		GP	Gray/Brown mf SAND, trace (-) fm Gravel. Wet at 2.0'								
5	0	SP	Lt. Brown/Black cmf SAND, little Gravel (Misc. Fill-brick, coal).		2					10.3	
		GP									
		SP	OUTWASH DEPOSITS								
		GP	Brown/Gray cmf SAND, trace Gravel, trace Organics.								
		SP	Lt. Gray cmf SAND. Wet to saturated.								
10	-5	SP	Gray/Black cmf SAND.		3					0.7	
		GP	Brown/Orange/Multi-colored cmf SAND and cmf GRAVEL.								
		SP	Lt. Brown/Orange cmf SAND, trace (-) f Gravel, trace Silt. Saturated.								
		GP									
15	-10	SP	Orange mfc SAND, trace (-) Gravel, trace Silt. Saturated.		4					0.7	
		GP									
20	-15										

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY		Permit Number: N/A	Boring No. SB-103
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/18/10 - 5/18/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.		Easting: 1255261.3 ft. Northing: 219274.5 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					36.2	Borehole backfilled with bentonite chips.
		SM	Brown/Dk. Brown fm SAND, little Silt, little Organics.								
		SP	Gray fmc SAND, little (+) Gravel. Moist								
		GP	Dk. Brown fmc SAND, little Silt, trace Gravel.								2.1' BGS: Slight to moderate tar-like odor.
		SP	Lt. Gray fmc SAND, wet.								
5	0	SP	Gray c SAND.		2						
		SP	Wood.							131	3.7' BGS: Brown NAPL coating soil grains, rainbow sheen. Moderate to strong tar-like odor.
		SP	Lt. Gray fmc SAND, moist.								5.0-5.9' BGS: Black staining, slight tar-like odor.
		GP	Black/Dk. Brown cmf SAND, some (+) mf Gravel (Misc. Fill-coal, brick).								5.9-6.5' BGS: Black stained, NAPL coating on soil grains. Brown NAPL on coarser material.
		SP	Lt. Gray/Black cmf SAND.								
		OL									
		SP	ALLUVIAL DEPOSITS								
10	-5	SP	Brown Silty CLAY and ORGANICS (peat).		3					6.3	6.6-7.2' BGS: Black stained, slight NAPL coating on soil grains, moderate tar-like odor.
		GP	OUTWASH DEPOSITS								
		SP	Black fmc SAND.								7.6-7.7' BGS: Black staining, sheen and tar-like odor.
		GP	Lt. Brown/Orange cmf SAND, little (+) Gravel (rounded).								7.8-9.0' BGS: Spots of sheen on coarser material.
		SP	Orange/Brown cmf SAND, little (+) fmc Gravel (rounded). Saturated.								
		SM	Lt. Brown/Orange fmc SAND, trace Silt, trace (-) Gravel.								
15	-10				4					3.1	
		SP	Lt. Brown/Orange fmc SAND, trace Silt, trace (-) Gravel.								
		SM									
20	-15										

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY		Permit Number: N/A	Boring No. SB-104 Page 1 of 1
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/18/10 - 5/18/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.		Easting: 1255180.3 ft. Northing: 219252.1 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					0.5	Borehole backfilled with bentonite chips. 1.6' BGS: Slight tar-like odor.
		SM	Brown fm SAND, little Silt, little Organics.								
		SP	Dk. Brown/Red fmc SAND, little (+)								
		GP	Gravel, trace Silt (Misc. Fill- brick, wood, coal).								
		SP	Black/Gray cmf SAND. Moist.								7.1' BGS: Sporadic black staining, slight tar-like odor.
		SP	Dk. Brown fm SAND, little Silt, trace Organics. Fire brick @ 3.0'								
5	0	SP	ALLUVIAL DEPOSITS		2					0.2	
		SM	Dk. Brown fm SAND, little Silt, trace Organics.								
		SP	Gray/Brown/Black fmc SAND, little (-)								
		GP	Silt, little Organics (layered).								
		SP	OUTWASH DEPOSITS								
		GP	Tan/Orange cmf SAND, little (+) Gravel (rounded). Saturated.								
10	-5	SP	Tan/Orange cmf SAND, little (-) fmc		3					0.2	
		GP	Gravel, trace Silt. Saturated.								
		SP	Tan/Orange fmc SAND, trace (-) Gravel,		4					0.0	
		GP	trace Silt. Saturated.								
15	-10										
20	-15										

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-105
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/18/10 - 5/18/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.3 ft.		Easting: 1255136.0 ft. Northing: 219248.2 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					0.3	Borehole backfilled with bentonite chips. 1.5-3.0' BGS: Sporadic black staining, faint tar-like odor.
		SM	Dk. Brown fm SAND, little Silt, trace Organics (topsoil).								
		SP	Gray/Black/Red cmf SAND, little (+) Gravel (Misc. Fill-brick).								
		GP									
		SP	OUTWASH DEPOSITS								
		SM	Brown/Tan fmc SAND, little (-) Silt, trace Gravel, Moist.								
5	0	SP	Brown/Gray mfc SAND, trace Silt, Saturated.		2					0.4	
		SM									
		SP	Lt. Tan/Beige fmc SAND, trace Silt. Saturated.								
		SM									
10	-5	SP	Lt. Tan/Beige fmc SAND, trace Silt. Saturated.		3					0	
		SM									
15	-10	SP	Lt. Tan/Beige fmc SAND, trace Silt. Saturated, Iron staining.		4					0	
		SM									
20											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-106
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/19/10 - 5/19/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.7 ft.		Easting: 1255124.4 ft. Northing: 219284.9 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP SM	FILL Dk. Brown fm SAND, little (+) Silt, trace Organics, Moist.		1					0.6	Borehole backfilled with bentonite chips. 0.2-1.1' BGS: Minor black staining, faint tar-like odor.
		SP GP OL	Dk. Brown/Brown cmf SAND, little Gravel (Misc. Fill-brick), little Silt.								
		SP SM	Dk. Brown SILT & CLAY, little (+) Organics (peat).								
5	0	SP SM SP GP	Dk. Brown/Tan mfc SAND, little Silt, trace (+) Gravel (Misc. Fill-coal), Moist.		2					0.3	
			OUTWASH DEPOSITS Beige/Tan mfc SAND, trace Silt, Wet. Beige/Tan/Multi-colored cmf SAND, little (-) fm Gravel (rounded), trace Silt. Iron staining. Wet to saturated.								
10	-5	SP GP	Beige/Tan/Multi-colored cmf SAND, little (-) fm Gravel (rounded), trace Silt. Iron staining. Wet to saturated.		3					0.3	
15	-10										
		SP GP	Beige/Tan/Multi-colored cmf SAND, little (-) fm Gravel (rounded), trace Silt. Iron staining. Wet to saturated.		4					0.2	
20	-15										

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-107
				N/A	Page 1 of 1

Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
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Start/Finish Date 5/19/10 - 5/19/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A
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Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.8 ft.	Easting: 1255122.4 ft. Northing: 219320.7 ft. TOC Elev: N/A ft.
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Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					2.1	Borehole backfilled with bentonite chips. 0.2-0.9' BGS: Faint tar-like odor
		SM	Dk. Brown mf SAND, little Silt, little Organics.								
		SP	Dk. Brown/Brown cmf SAND, little Gravel, Moist.								
		GP	Brown/Dk. Brown fmc SAND, little Silt, trace f Gravel.								
5	0	SP	OUTWASH DEPOSITS		2					0.3	
		SM	Tan/Beige mfc SAND, trace Silt, Wet.								
		SP	Tan/Beige/Orange fmc SAND, little (-) Silt, trace mf Gravel. Wet to saturated. Iron staining.								
		SM									
10	-5	SP	Beige mfc SAND, little Silt, trace (-) f Gravel. Wet to saturated.		3					0.2	
		SM									
15	-10	SP	Beige mfc SAND, little Silt, trace mf Gravel. Wet to saturated.		4					0.2	
		SM									
20	-15										

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-108
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 6.0 ft.
Start/Finish Date 5/19/10 - 5/19/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.4 ft.		Easting: 1255108.6 ft. Northing: 219358.8 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5 0		SP	FILL		1					4.3	Borehole backfilled with / bentonite chips. 2.5-2.6' BGS: Minor black staining, slight tar-like odor. Geoprobe refusal @ 6.0' BGS. Move over to location SB-108A.
		GP	Brown fmc SAND, little (+) Gravel, trace Silt, Moist.								
		SP	White/Beige fmc SAND, little (+) Gravel (pulverized).								
		SP	Brown mfc SAND, little Silt, trace Gravel, Wood chips.								
		SM	Brown fmc SAND, little Silt, little Gravel, trace Organics. Moist to wet.								
		SP	Brown fmc SAND, little Silt, little Gravel, trace Organics. Moist to wet.								
		GP	Brown fmc SAND, little Silt, little Gravel, trace Organics. Moist to wet.								
		GP	Brown fmc SAND, little Silt, little Gravel, trace Organics. Moist to wet.								
		GP	Brown fmc SAND, little Silt, little Gravel, trace Organics. Moist to wet.								
		SP	Lt. Gray/White mf GRAVEL (pulverized concrete), little (+) Sand. Wet.								

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY				Permit Number: N/A	Boring No. SB-108A
					Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 5.0 ft.	
Start/Finish Date 5/19/10 - 5/19/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.3 ft.		Easting: 1255108.6 ft. Northing: 219364.2 ft. TOC Elev: N/A ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5		SP	FILL		1					27.3	Borehole backfilled with bentonite chips. 1.75-1.9' BGS: Black hardened tar, moderate tar-like odor. 2.5-2.6' BGS: NAPL coating soil grains, sheen and NAPL blebs on liner. Moderate to strong tar-like odor. Geoprobe refusal @ 5.0' BGS.
		SP	Brown fmc SAND, little Organics.								
		GP	Brown/Dk. Brown cmf SAND, little (+)								
		SP	Gravel, trace Silt, trace Organics.								
		GP	Brown/Lt. Brown cmf SAND, little (-)								
		GP	Gravel, trace Silt. Moist to wet.								
		SP	Lt. Gray/White mf GRAVEL (pulverized concrete), little (+) Silt.								

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-109
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/19/10 - 5/19/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.1 ft.		Easting: 1255322.4 ft. Northing: 219280.0 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP GP	Asphalt		1					1.2	Borehole backfilled with bentonite chips. 1.7-2.5' BGS: Faint petroleum-like odor. 3.6-3.8' BGS: Minor black staining, hardened tar, moderate tar-like odor.
			FILL								
		SP	Dk. Brown/Black fm SAND, little (-)								
		SM	Gravel (Misc. Fill-cinders, brick).								
		SP	Brown/Tan fm SAND, little (-) Silt, trace								
		GP	Gravel.								
5	0	SP	Red/Brown/Purple fmc SAND, little								
		GP	Gravel (Misc. Fill) little Silt. Moist.								
		GP	ALLUVIAL DEPOSITS		2					0.3	
		GP	Red/Purple/Brown fmc SAND, little (+) f								
		PT	Gravel (shells). Moist.								
		SP	Red/Purple/Brown fmc SAND, little (+) f								
		SM	Gravel (shells). Moist.								
10	-5	SM	Dk. Brown/Brown SILT & CLAY and								
		SP	ORGANICS (peat) . Moist to wet.								
		SM	OUTWASH DEPOSITS								
		SP	Tan/Beige fmc SAND, little (-) Silt.		3					1.0	
		GP	Dk. Brown fmc SAND, little (+) Silt, trace								
		SP	(+) Organics.								
		GP	Tan/Beige cmf SAND, little (+) fmc								
			Gravel. Wet to saturated.								
			Tan/Beige cmf SAND, little (+) fmc								
			Gravel, trace Silt. Saturated.								
15	-10	SP GP	Tan/Beige cmf SAND, trace Gravel, trace		4					0.2	
			Silt. Saturated. Iron staining.								
20											

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY		Permit Number: N/A	Boring No. SB-110
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 20.0 ft.
Start/Finish Date 5/19/10 - 5/19/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.		Easting: 1255337.0 ft. Northing: 219225.5 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP GP	Asphalt		1					0.4	<i>Borehole backfilled with bentonite chips.</i>
			ALLUVIAL DEPOSITS								
			Dk. Brown cmf SAND, little (+) mf Gravel (rounded), Moist.								
		SP	Lt. Brown cmf SAND.								
5	0	SP	Brown fm SAND, little Silt, little Organics.								
		SM	Shells @ 3.65-3.7'.		2					0.5	
		SP	Beige mfc SAND.								
		SP	Beige mfc SAND.								
		PT	Dk. Brown f SAND, little Silt & Clay, little Organics (peat).								
		SP									
		SM	OUTWASH DEPOSITS								
		SP	Lt. Brown/Tan mfc SAND, little (-) Silt, trace (-) Gravel (rounded), Wet.								
10	-5	GP	Tan cmf SAND, little (+) fmc Gravel (rounded) trace Silt, wet.		3					0.1	
		SP	Tan/Orange cmf SAND, little (-) fm Gravel (rounded), trace Silt. Saturated. Iron staining.								
		GP									
15	-10	SP									
		GP	Tan/Lt. Brown cmf SAND, trace f Gravel, trace Silt, Saturated.		4					0.0	
20											

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-111	
					Page 1 of 1		
Geologist/Office C. Mino/Allendale, NJ		Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA		Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 10/4/10 - 10/4/10		Drilling Contractor: Zebra Env. Corp.		Sampling: Macrocore® Hammer Type: N/A		Development Method: N/A	
Driller: Luke Caballero		Drilling Method: Direct-push		Drilling Equipment: Geoprobe® 6600		Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.5 ft.	
						Easting: 1255112.6 ft. Northing: 1255112.0 ft. TOC Elev: N/A ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5		SP GP	FILL Lt. Gray fmc SAND, little Gravel (pulverized concrete/rock). Lt. brown fmc SAND, trace (+) fm Gravel. Wet. Beige fmc SAND, litte (-) fmc Gravel. Wet.		1					1.6	Borehole backfilled with bentonite chips. 0.5-1.7' BGS: Sporadic spots of black staining. Sample SB-111-7-9 collected and submitted for laboratory analysis. 7.1-7.3' BGS: Band of NAPL saturated soils (tacky), moderate tar-like odor. 7.3-8.2' BGS: Sheen extending from saturated soils and within soil core when broken apart. Sample SB-111-15-17 collected and submitted for laboratory analysis.
5	0	SP GP	Beige/tan mfc SAND, little (-) fm Gravel. Wet to saturated.		2					23.4	
10	-5	SP GP	Beige mfc SAND, trace (-) fm Gravel.		3					0.2	
15	-10	SP GP	Beige mfc SAND, trace (-) fm Gravel.		4					0.0	
20	-15	SP GP	Beige mcf SAND, trace (+) fm Gravel. Iron staining throughout.		5					0.0	
25											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-112
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 10/4/10 - 10/4/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6600	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.4 ft.		Easting: 1255112.0 ft. Northing: 219353.8 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	5	SP GP	FILL Brown fmc SAND, some (-) fmc Gravel, trace Organics. Wet.		1					0.9	Borehole backfilled with bentonite chips. 1.4-1.5' BGS: Black staining, faint tar-like odor. Sample SB-112-1-3 collected and submitted for laboratory analysis.
5	0	SP GP	Beige/tan mfc SAND, trace (+) f Gravel. Wet/saturated. Iron staining.		2					0.7	
10	-5	SP GP	Beige mfc SAND, trace (-) f Gravel. Wet/saturated. Iron staining.		3					0.7	
15	-10	SP GP	Beige mfc SAND, trace (-) f Gravel. Wet/saturated. Iron staining.		4					0.4	
20	-15	SP GP	Beige mfc SAND, trace (-) f Gravel. Wet/saturated. Iron staining.		5					0.0	
25											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-113
				N/A	Page 1 of 1
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/30/10 - 9/30/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.		Easting: 1255160.0 ft. Northing: 219341.6 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP GP	FILL Brown fmc SAND, trace Gravel, trace Organics.		1					0.0	Borehole backfilled with bentonite chips. Sample SB-113-1-3 collected and submitted for laboratory analysis. 1-2.4' BGS: Black staining, faint tar-like odor 3.1-3.3' BGS: Black staining, faint tar-like odor
5	0	SP GP	Gray fmc SAND, some Gravel (angular). Black/brown fmc SAND, trace (+) fm Gravel.		2					0.0	
10	-5	SP GP	Brown fmc SAND, trace (+) fm Gravel. Orange cmf SAND, trace f Gravel. Iron staining.		3					0.0	
15	-10	SP GP	OUTWASH DEPOSITS Tan/orange cmf SAND, little (+) fm Gravel. Wet.		4					0.0	
20	-15	SP GP	Tan/beige fmc SAND, little (-) fm Gravel. Wet.		5					0.0	
25		SP GP	Lt/ brown/tan mfc SAND, trace (+) fm Gravel. Wet.								Sample SB-113-20-22 collected and submitted for laboratory analysis.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-114
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/30/10 - 9/30/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.7 ft.		Easting: 1255172.0 ft. Northing: 219327.9 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
	5	SP	FILL	--	1					1.6	Borehole backfilled with bentonite chips. 0.9-2.2' BGS: Black staining, faint tar-like odor. Sample SB-114-1-3 collected and submitted for laboratory analysis.
		SP	Brown fmc SAND, trace Gravel, trace Organics.								
		GP	Gray/Brown fmc SAND, some fmc Gravel.								
		SP	Brown fmc SAND, little (-) fm Gravel.								
		GP	Moist to wet.								
5	0	SP	OUTWASH DEPOSITS	--	2					0.6	
		GP	Tan/Orange mfc SAND, little (+) fm Gravel. Wet. Iron staining throughout.								
10	-5	SP	Beige/Tan fmc SAND, trace (-) f Gravel. Iron staining.	--	3					1.8	
15	-10			--	4					0.4	
20	-15	SP	Beige/Tan fmc SAND. Wet. Iron staining.	--	5					0.0	Sample SB-114-20-22 collected and submitted for laboratory analysis.
25											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-115
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 30.0 ft.
Start/Finish Date 9/30/10 - 9/30/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.6 ft.		Easting: 1255181.0 ft. Northing: 219315.3 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
	5	SP GP SP GP SP GP	FILL Brown fmc SAND, little (-) Gravel, trace Organics. Gray fmc SAND, some (+) mf Gravel. Brown/Gray/Black fmc SAND, little (-) Gravel. Moist.	--	1					0.5	Borehole backfilled with bentonite chips. 1.3' BGS: Black staining, slight/moderate tar-like odor. 2-2.5' BGS: Soils slightly coated with NAPL.
5	0	SP SP	Dk. Brown/Gray fmc SAND, trace mf Gravel. Wet. Brown/Tan mfc SAND, trace (+) fmc Gravel. Wet. Piece of wood.	--	2					0.2	5-5.7' BGS: Faint tar-like odor. Sample SB-115-10-12 collected and submitted for laboratory analysis.
10	-5	SP GP	OUTWASH DEPOSITS Tan/Orange mfc SAND, little fm Gravel. Wet.	--	3					13.5	10.85 and 11.45' BGS: Band of soil coated with tacky NAPL, sheen, faint tar-like odor.
15	-10	SP	Tan mfc SAND, trace Gravel. Dk. Red Iron staining.	--	4					0.4	15-20' BGS sample interval: Sheen observed at bottom of acetate liner.
20	-15	SP	Tan mfc SAND, trace Gravel.	--	5					0.0	20' BGS: Few small specks of NAPL.
25	-20	SP	Beige/Tan fmc SAND, trace (-) f Gravel.	--	6					0.0	Sample SB-115-25-27 collected and submitted for laboratory analysis.
30											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-116
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/30/10 - 9/30/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.7 ft.		Easting: 1255185.6 ft. Northing: 219299.3 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
	5	SP GP	FILL Brown fmc SAND, little (-) fm Gravel, trace Organics.	--	1					1.0	Borehole backfilled with bentonite chips.
5	0	NR	No recovery.	--	2					3.2	5-10' BGS: Minimal sample recovery, sheen and black staining observed on acetate liner.
10	-5	SP GP	OUTWASH DEPOSITS Brown/Tan fmc SAND, little (+) fm Gravel. Wet to saturated.	--	3					9.7	Sample SB-116-11-13 collected and submitted for laboratory analysis.
15	-10	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet.	--	4					1.4	11' BGS: Black staining. 11.6-11.7' BGS: Black staining. 11.9' BGS: Band of soils coated with NAPL, sheen. 12-12.2' BGS: Black staining. 12.2' BGS: Band of soils coated with NAPL, sheen, faint/moderate tar-like odor.
20	-15			--	5					0.0	20.5' BGS: Very few specks of tacky NAPL. Sample SB-116-21-23 collected and submitted for laboratory analysis.
25											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-117 Page 1 of 1
	Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"
Start/Finish Date 9/30/10 - 9/30/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.		Easting: 1255181.2 ft. Northing: 219263.2 ft. TOC Elev: N/A ft.

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BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-118
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/27/10 - 9/27/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.		Easting: 1255191.0 ft. Northing: 219349.2 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL	--	1					202	<i>Borehole backfilled with bentonite chips.</i>
		GP	Brown fmc SAND, little Gravel, trace Silt, trace Organics.								
		SP	Gray fm SAND, little (+) mf Gravel (angular).								
		GP	Brown fm SAND, little (-) Gravel (Misc. Fill - brick, cinders).								
5	0	GP	Green/Blue tinge mf SAND, little Gravel (pieces of pulverized quartz).	--	2					62.7	2.3-3.2' BGS: Black stained and NAPL coated soils, moderate tar odor. 3.2' BGS: Blue-green stained material, sulfur-like odor. 5-10' BGS: NAPL coated sand grains, moderate/strong tar-like odor.
		SP	ALLUVIAL DEPOSITS								
		GP	Black fmc SAND, little (-) fmc Gravel. Moist to wet.								
10	-5	SP	Black fm SAND.	--	3					9.9	10-10.4' BGS: Black stained soils, moderate tar-like odor. 11.3' BGS: Lens of NAPL coated soils. 11.6' BGS: Lens of NAPL coated soils (more viscous than observed at 11.3').
		SP	OUTWASH DEPOSITS								
			Tan/Brown fm SAND. Wet.								
15	-10	SP	Tan fmc SAND. Wet to saturated.	--	4					9.7	15-15.5' BGS: Thin band of black viscous NAPL coated soils, moderate tar-like odor. 15.5-16' BGS: Sheen extending from saturated soil grains. Sample SB-118-15-17 collected and submitted for laboratory analysis.
20	-15			--	5					0.0	Sample SB-118-22-24 collected and submitted for laboratory analysis.
25											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-119
				N/A	Page 1 of 1

Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
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Start/Finish Date 9/28/10 - 9/28/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A
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Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.	Easting: 219364.5 ft. Northing: 1255201.5 ft. TOC Elev: N/A ft.
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Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP	FILL Brown/Gray fmc SAND, little (-) fmc Gravel (Misc. Fill - brick, cinders). Black f SAND and SILT. Black fm SAND, trace f Gravel. Green/White cmf GRAVEL (pulverized rock - quartz), little (-) Sand.	--	1					89.2	Borehole backfilled with bentonite chips. 1.1-1.3' BGS: NAPL coated soils 1.3-3' BGS: NAPL coating/NAPL saturated, moderate tar-like odor.
		GP									
		SP									
		SP									
		GP									
5	0	SP	ALLUVIAL DEPOSITS Brown mf SAND, trace Organics. Dk. Brown SILT and f SAND, little Organics. Gray/Dk. Gray fmc SAND.	--	2					19.6	5-5.9' BGS: Black stained/NAPL coated soils. 6.8' BGS: Sheen extending from saturated soils, sporadic specks/blebs of NAPL. 7.4' BGS: Band/lens of NAPL. 10.7' BGS: Black staining, sheen and NAPL coating on gravel. 10.8' BGS: Band/lens of tacky NAPL within coarser grained material, moderate tar-like odor.
		SM									
		ML									
		SP									
		GP									
10	-5	SP	OUTWASH DEPOSITS Tan/Beige SAND and GRAVEL. Wet @ 7.4'. Tan/Orange fm SAND, trace fm Gravel. Wet.	--	3					9.0	Sample SB-119-11-13 collected and submitted for laboratory analysis.
		GP									
		SP									
		GP									
		SP									
15	-10	SP	Tan fmc SAND, trace f Gravel. Wet. Iron staining.	--	4					0.0	20-25' BGS: Spots of sheen on water within acetate liner, but not within soil core when broken apart. Sample SB-119-22-24 collected and submitted for laboratory analysis.
		GP									
		SP									
		GP									
		SP									
20	-15	SP	Tan/Orange fmc SAND, trace (-) f Gravel. Wet. Iron staining.	--	5					0.0	
		GP									
		SP									
		GP									
		SP									
25	-20	SP									
		GP									
		SP									
		GP									
		SP									

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-120
				N/A	Page 1 of 1
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/27/10 - 9/27/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.		Easting: 219356.2 ft. Northing: 1255219.7 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP GP	FILL Brown/Gray fmc SAND, little Gravel. Red SAND, little Gravel (Misc. Fill - pulverized brick/fire brick). Brown/Gray fm SAND. Lt. Gray fm SAND, little (+) fmc GRAVEL, trace Silt. Compact.	--	1					139	Borehole backfilled with bentonite chips.
		SP GP	Gray/Brown fmc SAND, little f Gravel (Misc. Fill - brick). Saturated.	--	2					136	1.7-3' BGS: Black staining, moderate tar-like odor. 3'-3.1 BGS: NAPL coating, blebs/sheen extending from saturated soil grains. 3.1-3.7' BGS: moderate tar-like odor. 5-6.7' BGS: NAPL coating/saturated, moderate tar-like odor. 6.7-8.3' BGS: Black stained soils, sheen throughout, moderate tar-like odor. 8.3-9.5' BGS: Sheen
10	-5	SP	ALLUVIAL DEPOSITS Gray/Black fm SAND, trace Organics.	--	3					31.9	extending from saturated soils, moderate tar-like odor. 10-10.7' BGS: Bands of black staining/NAPL coated soils, sheen, moderate tar-like odor. 10.7-11.3; BGS: Sheen extending from saturated soils.
15	-10	GP SP	OUTWASH DEPOSITS Brown/Tan cmf SAND and fmc GRAVEL.	--	4					17.9	11.3-11.4' BGS: Black staining, NAPL (tacky to touch). 12.2-12.3' BGS: Lens of NAPL (tacky to touch). 15.9-16.1' BGS: NAPL saturated (tacky to touch), moderate to strong tar-like odor.
20	-15	SP	Tan fmc SAND. Saturated.	--	5					0.0	16.1-16.8' BGS: Sheen extending from saturated soils, moderate tar-like odor. 16.5' BGS: Lens of tacky NAPL.
25	-20			--							Sample SB-120-15-17 collected and submitted for laboratory analysis. Sample SB-120-22-24 collected and submitted for laboratory analysis.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-121
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/28/10 - 9/28/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.1 ft.		Easting: 219340.4 ft. Northing: 1255204.7 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP	FILL	--	1					85.2	Borehole backfilled with bentonite chips. Sample SB-121-2-4 collected and submitted for laboratory analysis. 2.4-2.9' BGS: NAPL coating soil, moderate tar-like odor. 2.4, 2.7' BGS: Sand with blue tinge, faint sulfur-like odor. 5-5.4' BGS: NAPL coating on soil grains, moderate tar-like odor. 5.8-7' BGS: Slight tar-like odor. 7-7.4' BGS: Sheen extending from saturated soil grains, slight tar-like odor 11.5-11.7' BGS: Globules of viscous NAPL (tacky to touch). 11.7' BGS: Lens of NAPL. Sample SB-121-15-17 collected and submitted for laboratory analysis. 15.2-17' BGS: Lenses of tacky NAPL concentrated around coarser grained material, sheen throughout, moderate tar-like odor.
		GP	Brown fmc SAND, little (+) Gravel, trace Organics.								
		SP	Brown/Gray/Black cmf SAND, little Gravel (Misc. Fill - brick).								
		GP	Dk. Brown/Black fm SAND, little (-) f Gravel.								
		GP									
10	-5	SP	ALLUVIAL DEPOSITS	--	2					10.5	
		ML	Brown fmc SAND.								
		CL	Dk. Brown SILT and CLAY.								
		GP	OUTWASH DEPOSITS								
		SP	Brown/Tan fmc SAND and GRAVEL. Moist to wet.								
15	-10	SP	Tan/Beige mfc SAND, little (+) fm Gravel. Wet. Iron staining.	--	3					2.4	
		GP									
20	-15	SP	Tan/Orange mcf SAND, trace (-) f Gravel. Iron staining. Wet to saturated.	--	4					6.7	
25	-20	SP	Orange/Tan mf SAND, trace (-) f Gravel. Wet to saturated.	--	5					0.0	
											Sample SB-121-22-24 collected and submitted for laboratory analysis.

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY		Permit Number: N/A	Boring No. SB-122
		Page 1 of 1			
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 28.0 ft.
Start/Finish Date 9/28/10 - 9/28/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.		Easting: 219354.3 ft. Northing: 1255200.9 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP	FILL Brown mf SAND, trace Gravel, trace Organics.	--	1					210	Borehole backfilled with bentonite chips.
		GP	Gray/Brown fmc SAND, little (+) Gravel (Misc. Fill - brick).								
		CL	Red CLAY.								
		SP	Brown/White fmc SAND, little (+) Gravel (pulverized rock).								
		GP	Brown mf SAND, trace f Gravel. Moist.	--	2					386	5-5.7' BGS: NAPL saturated, strong tar-like odor.
		SP	Green/White GRAVEL (pulverized quartz).								
		GP	Brown/Black fmc SAND, trace Gravel.								
		SP	Tan/Beige SAND and GRAVEL.								
10	-5		ALLUVIAL DEPOSITS Black fm SAND. Wet to saturated.								
		SP	OUTWASH DEPOSITS Tan/Beige mfc SAND, little (+) f Gravel. Wet to saturated.	--	3					52.4	10.8-10.9' BGS: Tacky NAPL coating on soils, sheen.
		GP									
15	-10	SP	Tan/Orange mfc SAND. Wet to saturated.	--	4					7.0	11.2-11.5' BGS: NAPL saturated (tacky). 11.7, 11.8' BGS: Lenses of tacky NAPL. 11.8 to 12.3': Sheen extending from saturated soil grains. 15.9' BGS: Black stained soils.
20	-15	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet to saturated.	--	5					10.1	16.05-16.1' BGS: Lenses of tacky NAPL, moderate tar-like odor.
25	-20	SP	Tan/Beige mcf SAND. Wet.	--	6					0.0	Sample SB-122-20-22 collected and submitted for laboratory analysis. 20.65-20.75' BGS: Lenses/bands of NAPL coated soils, moderate tar-like odor.
											Sample SB-122-25-27 collected and submitted for laboratory analysis.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-123
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 30.0 ft.
Start/Finish Date 9/28/10 - 9/28/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.1 ft.		Easting: 219315.0 ft. Northing: 1255222.3 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP	FILL Brown cmf SAND, little (-) Gravel, trace Organics.	--	1					236	Borehole backfilled with bentonite chips. 1.1-1.9' BGS: Black stained soils, moderate tar-like odor. 1.9-3.2' BGS: NAPL coating on soil grains. 1.9-2.2' BGS: NAPL saturated, moderate tar-like odor. 5-6.1' BGS: NAPL coating on soil grains, moderate tar-like odor. 6.1- 8.1' BGS: Sporadic blebs of NAPL and sheen concentrated around gravel.
		GP	Gray fmc SAND, little (+) Gravel.								
		SP	Brown/Black fmc SAND, little (-) Gravel								
		GP	(Misc. Fill - brick), trace Organics.								
		SP	Gray/Brown fm SAND, trace (-) Gravel.								
		GP	Gray/Brown fm SAND, trace (-) Gravel., trace Organics.	--	2					36.7	
		GP	OUTWASH DEPOSITS								Sample SB-123-15-17 collected and submitted for laboratory analysis. 11.2' BGS: Few NAPL blebs on coarse grained material. 11.9-12, 12.6' BGS: Bands of black staining, slight NAPL coating, sheen, moderate tar-like odor. 15-15.6' BGS: Sheen, sporadic black staining. 15.6-16' BGS: NAPL coating, sheen, moderate tar-like odor. 16-16.5' BGS: NAPL saturated. 16.5-16.9' BGS: Sheen. 16.9-17.2' BGS: NAPL saturated. Sample SB-123-20-22 collected and submitted for laboratory analysis.
		SP	Tan cmf SAND and fmc GRAVEL. Wet.								
10	-5	SP	Tan/Orange fmc SAND, trace (+) fmc Gravel. Wet.	--	3					4.7	
15	-10	SP	Orange/Tan fm SAND, trace Gravel.	--	4					24.9	
											Sample SB-123-20-22 collected and submitted for laboratory analysis.
20	-15	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet.	--	5					0.0	
25	-20			--	6					0.0	
30											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-124
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/27/10 - 9/27/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.7 ft.		Easting: 219314.8 ft. Northing: 1255246.9 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
0 5 10 15 20 25	0	SP GP	FILL Gray/Brown cmf SAND, some Gravel.	--	1					11.9	0.7-1.7' BGS: Slight tar-like odor. <i>Borehole backfilled with bentonite chips.</i> 2.1-2.2' BGS, 3.3'-3.9' BGS: Black staining, moderate to strong tar-like odor. Sample SB-124-2-4 collected and submitted for laboratory analysis. 6-7' BGS: Sporadic black staining. Moderate/faint tar-like odor. 12.9' BGS: Few NAPL blebs and sheen on soil grains. Moderate tar-like odor.
		SP GP	Black cmf SAND, little (+) fm Gravel (Misc. Fill - cinders). Moist.								
		SP GP	Brown/Tan mfc SAND, trace f Gravel. Moist to wet.								
	-5	SP GP	OUTWASH DEPOSITS Lt. Gray fm SAND, little fm Gravel.	--	2					4.2	
		GP SP SP GP	Lt. Gray/Tan cmf SAND and GRAVEL. Lt. Tan/Beige cm SAND, little (-) fm Gravel. Wet.								
	-10	SP GP	Orange/Tan mcf SAND, little (-) f Gravel. Wet to saturated.	--	3					0.2	Sample SB-124-22-24 collected and submitted for laboratory analysis.
	-15	SP	Orange/Tan fmc SAND. Wet to saturated.	--	4					0.0	
	-20			--	5					0.0	

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-125
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 30.0 ft.
Start/Finish Date 9/30/10 - 9/30/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.		Easting: 219279.0 ft. Northing: 1255206.5 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					1.3	Borehole backfilled with bentonite chips. 0-5' BGS: Faint tar-like odor.
		GP	Brown fmc SAND, little (-) Gravel, trace Organics.								
		SP	Gray fmc SAND, some (+) Gravel.								
		SP	Dk. Brown/Black cmf SAND, little (+) Gravel (Misc. Fill - brick, cinders).								
		GP									
5	0	SP	Brown mfc SAND, trace (+) mf Gravel. Wet.	--	2					0.1	5-6' BGS: Sheen on soil grains and on water, faint tar-like odor.
10	-5	SP	OUTWASH DEPOSITS Tan/Orange mfc SAND, trace (+) fm Gravel. Wet. Iron staining.	--	3					0.3	12-12.4' BGS: Faint tar-like odor.
15	-10	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet.	--	4					0.3	15.4-15.8' BGS: Very few spots of NAPL coated soils (tacky), faint tar-like odor.
20	-15	SP	Tan/Brown fmc SAND, trace (-) f Gravel.	--	5					9.5	20.7-20.8' BGS: Band of soils coated with tacky NAPL.
25	-20	SP	Tan/Orange mfc SAND, trace (+) f Gravel. Wet. Fe staining.	--	6					0.0	20.8-21.2' BGS: Sheen extending from saturated soils, but not within soil core when broken apart. Sample SB-125-20-22 collected and submitted for laboratory analysis. Sample SB-125-25-27 collected and submitted for laboratory analysis.
30	-25										

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-126
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/27/10 - 9/27/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.5 ft.		Easting: 219284.2 ft. Northing: 1255240.4 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
	0	SP GP	FILL Gray/Brown cmf SAND, some Gravel, trace Organics. Dk. Brown/Black fmc SAND, little (+) fmc Gravel (Misc. Fill - brick, cinders, wood). Moist.	--	1					152	Borehole backfilled with bentonite chips. 1.9-2.4' BGS: Sheen, moderate tar-like odor. 1.9-2.4' BGS: Sheen on grains, moderate tar-like odor. 2.9-3' BGS: NAPL coating sand and gravel, tacky to touch, moderate to strong tar-like odor. 5-6.8' BGS: NAPL coated/saturated, moderate tar-like odor. 8.1' BGS: NAPL saturated. 8.1-8.3' BGS: Black stained soils. 8.3' BGS: Sporadic sheen and black staining throughout, moderate tar-like odor. 11.7, 11.9-12.1, 12.2-12.4' BGS: Spots of sheen and black staining, moderate tar-like odor. 15-20' BGS: Spots of sheen on sides of core, but not inside core when broken apart. Sample SB-126-5-7 collected and submitted for laboratory analysis. Sample SB-126-22-24 collected and submitted for laboratory analysis.
5		SP GP	Brown mfc SAND, little (+) f Gravel.	--	2					324	
	-5	GP SP	OUTWASH DEPOSITS Tan/Brown SAND and GRAVEL. Moist to wet.	--	3					18.5	
10		SP GP	Tan/Brown cmf SAND, little (+) fmc Gravel. Wet.	--	4					0.0	
15	-10	SP	Orange/Tan fmc SAND. Wet.	--	5					0.0	
	-15	SP	Tan/Beige fmc SAND, trace f Gravel. Wet to saturated.	--							
20											
	-20										
25											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-127
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/27/10 - 9/27/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.8 ft.		Easting: 219268.1 ft. Northing: 1255247.6 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP GP SP GP	FILL Lt. Brown/Gray fmc SAND, little (+) cmf Gravel, trace Organics. Brown/Dk. Brown fmc SAND, little Gravel (Misc. Fill - brick, cinders, glass).	--	1					28.3	Borehole backfilled with bentonite chips.
5	0	SP	Dk. Brown/Gray cmf SAND, trace (+) Gravel (Misc. Fill - cinders, brick).	--	2					76.1	1.8-3.1' BGS: Faint to moderate tar-like odor. 2.8-3.1' BGS: Sheen (especially surrounding coarser grained material).
		SP SM GP SP	ALLUVIAL DEPOSITS Beige fmc SAND. Wet. Brown fm SAND, little Silt.								
10	-5	SP	OUTWASH DEPOSITS Beige/Tan SAND and GRAVEL.	--	3					2.3	5-5.7' BGS: Sheen, moderate tar-like odor. 5.7'-6 BGS: NAPL saturated, moderate tar-like odor. 6-6.6' BGS: Sporadic sheen, black stained soils. 6.8' BGS: Sheen on outside of soil core, but not inside core when broken apart. 10-15' BGS: Sporadic spots of sheen extending from saturated soils Sample SB-127-5-7 collected and submitted for laboratory analysis.
15	-10	SP	Tan fm SAND. Wet to saturated.	--	4					0.0	15-20' BGS: Spots of sheen on outside of soil core, but not inside core when broken apart.
20	-15			--	5					0.0	
25	-20										Sample SB-127-22-24 collected and submitted for laboratory analysis.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-128
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 30.0 ft.
Start/Finish Date 9/29/10 - 9/29/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.		Easting: 219245.1 ft. Northing: 1255247.0 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					6.9	Borehole backfilled with bentonite chips.
		GP	Gray/Brown fmc SAND, little (+) Gravel, trace Organics.								
		SP	Black/Gray fmc SAND, little (+) Gravel (Misc. Fill - brick, cinders). Moist to wet.								
		SP	Tan/Brown fm SAND, trace (+) fm Gravel. Wet.								
5	0	GP	Black/Gray fmc GRAVEL (pulverized rock), little (-) Sand. Wet.		2					60.3	5-6' BGS: Black stained soils, slight tar-like odor.
		GP	Gray/Black cmf SAND, little (-) Gravel.								
		ML	ALLUVIAL DEPOSITS								
		CL	Dk. Brown SILT and CLAY, little Organics.								
		SP	Lt. Gray fmc SAND, little (+) Gravel (rounded). Spots of tidal marsh @ 7.0 and 7.1'.								
10	-5	GP	OUTWASH DEPOSITS								
		SP	Gray SAND and GRAVEL. Wet.		3					17.5	10-10.4' BGS: Sheen.
		SP	Tan/Lt. Brown mfc SAND, trace (-) f Gravel.								
15	-10	SP	Tan/Lt. Brown mfc SAND, trace (-) fm Gravel. Wet to saturated.		4					19	15-15.4' BGS: Black stained soils, moderate tar-like odor. 15.8-16' BGS: Black stained soils. 15.9-16' BGS: Bands of soil heavily coated with NAPL. 16-17.5' BGS: Sheen extending from saturated soils.
20	-15	SP	Tan/Orange mfc SAND, trace (+) fm Gravel. Wet.		5					10.9	20.2' BGS: Bands of soils coated with tacky NAPL, sheen, faint tar-like odor. Sample SB-128-20-22 collected and submitted for laboratory analysis. Sample SB-128-25-27 collected and submitted for laboratory analysis.
25	-20	SP	Tan/Orange mfc SAND. Wet. Iron staining.		6					0.0	
30	-25										

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-129
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 30.0 ft.
Start/Finish Date 9/29/10 - 9/29/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.		Easting: 219243.2 ft. Northing: 1255226.9 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP GP	FILL Brown fm SAND, little Gravel, trace Organics.	--	1					282	Borehole backfilled with bentonite chips.
		GP	Gray fm SAND, little Gravel.								
		SP	Gray/Black fmc SAND, little (+) Gravel								
		GP	(Misc. Fill - brick, cinders).								
		SP	Gray/Tan mfc SAND, little Gravel.								
		GP	Black cmf SAND, little (+) mf Gravel								
		SP	(Misc. Fill - cinders). Wet.	--	2					40.2	3.6' BGS: Sheen, slight tar-like odor.
		GP									
		SP	ALLUVIAL DEPOSITS								
		SP	Brown f SAND and SILT, trace Organics.								
		SM	Brown fm SAND, trace f Gravel. Wet.								
		SP									
		GP	OUTWASH DEPOSITS								
		SP	Tan/Beige cmf SAND and GRAVEL.								
10	-5	GP									
		SP	Tan/Orange mfc SAND, little (-) fm Gravel. Wet to saturated.	--	3					45.6	5-5.3' BGS: Sheen, slight tar-like odor. 6' BGS: NAPL coated soils. 6.2-6.4' BGS: NAPL saturated soils. 6.4-7.5' BGS: Sheen and NAPL blebs throughout. 6.8' BGS: Soils heavily coated with NAPL.
		GP									
15	-10	SP	Tan fmc SAND, little (+) fm Gravel. Wet.	--	4					132	15.7-16' BGS: Bands and spots of NAPL coated soils (tacky), moderate tar-like odor. 16-17.3' BGS: Sheen extending from saturated soils.
		GP									
20	-15	SP	Tan/range fmc SAND. Wet. Iron staining.	--	5					65.8	
25	-20			--	6					0.0	22.05' BGS: Thin band of stringy NAPL with sheen surrounding it, faint tar-like odor. Sample SB-129-22-24 collected and submitted for laboratory analysis. Sample SB-129-26-28 collected and submitted for laboratory analysis.
30											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-130
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/29/10 - 9/29/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.4 ft.		Easting: 219256.9 ft. Northing: 1255207.7 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					3	Borehole backfilled with bentonite chips.
		GP	Brown fmc SAND, little Gravel, trace Organics.								
		SP	Gray cmf SAND, some fmc Gravel. Moist.								
		GP	Black/Red/Gray fmc SAND, little (+) Gravel (Misc. Fill - brick, cinders, pulverized rock). Moist.								
		GP	Gray/Brown mf SAND, trace f Gravel.								
5	0	SP									
		GP	Black/Gray fm GRAVEL, little (-) Sand.		2					73.1	5-5.6' BGS: Minor black staining, faint tar-like odor.
		SP	ALLUVIAL DEPOSITS								
		ML	Dk. Brown SILT and CLAY, little Organics.								
		CL	OUTWASH DEPOSITS								
		SP	Tan/Gray mfc SAND, trace fm Gravel.								
		SP	Tan/Lt. Brown cmf SAND, some (+) fmc Gravel. Wet.								
10	-5	GP			3					6.7	10-15' BGS: Faint tar-like odor.
		SP	Tan/Orange mfc SAND, trace (+) fm Gravel. Wet.								
15	-10	SP	Tan/Orange fmc SAND, trace (-) f Gravel.		4					6.7	15.9' BGS: Lens/band of black stained soil, slightly coated with NAPL.
20	-15	SP	Tan/Orange mfc SAND. Wet.		5					0.0	Sample SB-130-16-18 collected and submitted for laboratory analysis.
25											17.2' BGS: Thin band of tacky NAPL.
											17.2-17.8' BGS: Sheen extending from saturated soils.
											Sample SB-130-20-22 collected and submitted for laboratory analysis.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-131
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 30.0 ft.
Start/Finish Date 9/29/10 - 9/29/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.		Easting: 219265.3 ft. Northing: 1255226.0 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
0		SP GP	FILL Brown/Gray fmc SAND, little (+) fm Gravel, trace Organics.	--	1					59.7	Borehole backfilled with bentonite chips. 1.2-2' BGS: Slight NAPL coating on soil grains, slight tar-like odor. 2-5.4' BGS: Heavy NAPL coating on soils, moderate tar-like odor.
5		SP GP	Gray/Dk. Gray cmf SAND, little (+) cmf Gravel (Misc. Fill - brick, cinders). Moist to wet. Gray/Brown fm SAND, little (-) f Gravel.	--	2					3.8	
		ML CL	ALLUVIAL DEPOSITS Brown SILT & CLAY, little (+) Organics.	--							5.6-6.4' BGS: Sheen. 5.6-8.1' BGS: Slight sheen, faint tar-like odor.
		SP ML CL	Tan/Beige mfc SAND. Wet. Brown SILT & CLAY, little (+) Organics.	--							
		SP GP	OUTWASH DEPOSITS Tan/Beige cmf SAND, some (+) fmc Gravel. Wet to saturated,	--							10.95' BGS: Band of tacky NAPL. 11.3, 11.6, 11.65 and 11.8' BGS: Spots of NAPL coated soils and sheen.
10	-5	SP GP	Tan/Orange cmf SAND, some (+) fmc Gravel.	--	3					60.4	
		SP GP	Tan/Orange mfc SAND, little (+) fmc Gravel. Wet.	--							15.6-15.75' BGS: Band of NAPL coated soils, slight tar-like odor. 5.75-16.3' BGS: Sheen. 16.3-16.4' BGS: Band of NAPL saturated soils. 16.4-17.3' BGS: Sheen.
15	-10	SP	Tan/Orange mfc SAND, trace f Gravel. Wet to saturated.	--	4					14.7	
		SP	Tan/Beige mfc SAND. Wet to saturated.	--							20.95-21' BGS: Bands of soils heavily coated with NAPL. Sample SB-131-21-23 collected and submitted for laboratory analysis. 21.55-21.7' BGS: NAPL saturated soils. 21.85' BGS: Band of soil heavily coated with NAPL. 22' BGS: Spots of NAPL coated soils. 22.2-22.3' BGS: Spots of NAPL coated soils, sheen. Sample SB-131-25-27 collected and submitted for laboratory analysis.
20	-15	SP	Tan/Orange mfc SAND. Wet.	--	5					11.9	
		SP	Tan/Orange mfc SAND. Wet.	--							
25	-20	SP	Tan/Orange mfc SAND. Wet.	--	6					0.0	
		SP	Tan/Orange mfc SAND. Wet.	--							
30	-25	SP	Tan/Orange mfc SAND. Wet.	--							

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-132
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 30.0 ft.
Start/Finish Date 9/29/10 - 9/29/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.		Easting: 219258.0 ft. Northing: 1255223.9 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					11.9	Borehole backfilled with bentonite chips. 1.9-2.4' BGS: Sporadic black staining, faint tar-like odor. 2.4-2.6' BGS: Soils slightly coated with NAPL.
		GP	Brown fmc SAND, little (+) Gravel, trace Organics.								
		SP	Gray/Black cmf SAND, little (+) Gravel (Misc. Fill - brick, cinders). Moist.								
		SP	Brown mf SAND.								
		GP	Black fmc GRAVEL, little Sand.								
5	0	GP	Black fmc GRAVEL, little Sand, trace Organics.	--	2					104	
		SP	Tan/Beige mfc SAND, trace f Gravel.								5-5.4' BGS: NAPL saturated soils. 5.4-6.1' BGS: Sheen throughout, few bands of soils coated with NAPL. 6.3-7.9' BGS: Sheen, few spots of black staining.
		ML									
		CL	ALLUVIAL DEPOSITS								
		SP	Brown SILT & CLAY, little Organics.								
		GP	OUTWASH DEPOSITS								
			Tan/Orange cmf SAND, little (+) fmc Gravel. Wet.								
10	-5	SP	Tan/Orange mfc SAND, little (+) fmc Gravel. Wet.	--	3					1.3	15.7' BGS: Band of soils coated with NAPL, sheen, moderate tar-like odor. 15.7-17.5' BGS: Sheen. 17.5' BGS: Slight tar-like odor.
		GP									
15	-10	SP	Tan fmc SAND, trace (+) f Gravel. Wet.	--	4					13.1	21.6-21.7' BGS: NAPL saturated soils (slightly tacky). 21.7-22.4' BGS: Sheen extending from saturated soils, several NAPL blebs extending from soils. Sample SB-132-21-23 collected and submitted for laboratory analysis. Sample SB-132-25-27 collected and submitted for laboratory analysis.
20	-15	SP	Tan/Orange fmc SAND, trace (+) fmc Gravel.	--	5					17.5	
25	-20	SP	Orange/Tan cmf SAND, trace fmc Gravel. Wet.								
30	-25	SP	Tan/Orange mf SAND. Wet.	--	6					0.0	

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-133
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 25.0 ft.
Start/Finish Date 9/28/10 - 9/28/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A	
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.3 ft.		Easting: 219380.1 ft. Northing: 1255207.8 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
	0	SP GP GP SP SP	FILL Brown cmf SAND, little Gravel (Misc. Fill - brick, cinders), trace Organics. Gray fm GRAVEL, little c Sand. Brown/Tan cmf SAND, trace Gravel, trace Silt, trace Organics.	--	1					2.8	Borehole backfilled with bentonite chips. 0.9-2.8' BGS: Faint tar-like odor.
5		SP GP	Brown/Lt. Brown mfc SAND, little (-) fm Gravel. Wet.	--	2					0.7	
	-5	SP GP SP GP	OUTWASH DEPOSITS Brown/Lt. Brown mfc SAND, some (-) fm Gravel. Wet. Brown/Lt. Brown mfc SAND, little (-) fm Gravel. Wet.								
10		SP	Beige/Tan mfc SAND, trace (-) fmc Gravel. Wet.	--	3					0.0	
15	-10	SP	Tan/Orange fmc SAND, trace f Gravel. Wet.	--	4					0.9	15' BGS: Small spots of sheen. 16-3.16.8' BGS: Slight sheen on saturated soils. Sample SB-133-15-17 collected and submitted for laboratory analysis.
20	-15	SP	Tan/Beige mfc SAND, trace f Gravel. Wet.	--	5					0.0	
25	-20										Sample SB-133-22-24 collected and submitted for laboratory analysis.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY				Permit Number: N/A	Boring No. SB-134
					Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 10.0 ft.	
Start/Finish Date 10/6/10 - 10/6/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A			
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.1 ft.		Easting: 219342.7 ft. Northing: 1255114.4 ft. TOC Elev: N/A ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	FILL		1					0.0	Borehole backfilled with bentonite chips.
		SP	Dk. Brown fmc SAND, little (+) Gravel, trace Organics. Wet.								
		SP	Brown mfc SAND, little (-) fm Gravel. Moist to wet.								
			Beige mfc SAND, little (-) fm Gravel. Moist to wet. Iron staining.								
5	0	SP	Beige mfc SAND, trace fm Gravel. Wet to saturated.		2					0.0	Sample SB-134-5-7 collected and submitted for laboratory analysis.
10											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY				Permit Number: N/A	Boring No. SB-135
					Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 10.0 ft.	
Start/Finish Date 10/6/10 - 10/6/10		Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.4 ft.		Easting: 219363.5 ft. Northing: 1255105.7 ft. TOC Elev: N/A ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP GP	FILL Dk. Brown fm SAND, little Organics. Brown/tan mfc SAND, trace (+) fm Gravel. Beige mfc SAND, little (+) fm Gravel. Wet.		1					0.0	Borehole backfilled with bentonite chips.
5	0	SP GP	Beige/tan mfc SAND, little (-) fm Gravel. Wet.		2					0.0	Sample SB-135-5-7 collected and submitted for laboratory analysis.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 138893 Project Location: Patchogue, NY			Permit Number: N/A	Boring No. SB-136
				Page 1 of 1	
Geologist/Office C. Mino/Allendale, NJ	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: N/A"	Total Boring Depth (ft) 10.0 ft.
Start/Finish Date 10/6/10 - 10/6/10	Drilling Contractor: Zebra Env. Corp.	Sampling: Macrocore® Hammer Type: N/A	Development Method: N/A		
Driller: Luke Caballero	Drilling Method: Direct-push	Drilling Equipment: Geoprobe® 6620DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.6 ft.		Easting: 219374.5 ft. Northing: 1255120.6 ft. TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
	5	SP	FILL		1					0.0	Borehole backfilled with bentonite chips.
		SP	Dk. Brown fm SAND, trace Gravel, tace Organics.								
		SP	Brown fmc SAND, trace fm Gravel, trae (-) Organics. Wet.								Sample SB-136-5-7 collected and submitted for laboratory analysis.
		SP	Beige fmc SAND, trace fm Gravel, trae (-) Organics. Wet.								
5	0	SP	Tan/beige mfc SAND, little (-) fm Gravel. Wet.		2					0.0	
		GP									
10											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY				Permit Number: NA	Boring No. SB-201
					Page 1 of 1	
Inspector/Office BFT/Albany, NY		Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 10.0 ft.
Start/Finish Date 5/8/14 - 5/8/14		Drilling Contractor: ADT, Inc.	Sampling: Macrocore® Hammer Type: NA		Development Method: NA	
Driller: C. Migliore	Drilling Method: Direct-Push	Drilling Equipment: Geoprobe® 7720DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.0 ft.		Easting: 1255313.3 ft. Northing: 219241.8 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SW	Asphalt	N/A						2.3	Boring backfilled with bentonite.
		SP	FILL Discolored black cmf SAND, some (-) mf Gravel (including coal/coke material). Dry.								
		SW	ALLUVIAL DEPOSITS Discolored black/dark brown mf SAND, some Silt, some (-) Organic (wood debris). Moist.								
5	0	SW		N/A						7.2	3.5-4.5' BGS: Slight organic-like odor.
		SP	Discolored black cmf SAND, some Silt, some (+) Organics (wood debris). Moist to Saturated at 3.5' BGS.								
		SW	Discolored black cmf SAND, some Silt, some (+) Organics (wood debris). Saturated.								
		SP	Brown mf SAND, little (-) Silt. Saturated.								
		SW	Discolored black ORGANICS (wood debris). Saturated.								
		GP	Light brown/grey mf SAND, trace Silt. Saturated.								
			OUTWASH DEPOSITS Brown/red brown cmf SAND and mf GRAVEL, trace (-) Silt. Saturated.								
10											
15											
20											
25											
30											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY			Permit Number: NA	Boring No. SB-202
				NA	Page 1 of 1

Inspector/Office BFT/Albany, NY	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 17.0 ft.
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Start/Finish Date 5/8/14 - 5/8/14	Drilling Contractor: ADT, Inc.	Sampling: Macrocore® Hammer Type: NA	Development Method: NA
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Driller: C. Migliore	Drilling Method: Direct-Push	Drilling Equipment: Geoprobe® 7720DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 4.9 ft.	Easting: 1255290.1 ft. Northing: 219242.9 ft. TOC Elev: NA ft.
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Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SW	Asphalt FILL	NA						1.6	Boring backfilled with bentonite.
		SP	Discolored black cmf SAND, some (+) mf Gravel (includes coal/coke material). Dry.								1.8-3.0' BGS: Slight organic-like odor.
		SP	ALLUVIAL DEPOSITS								
		SP	Discolored black mf SAND, little (+) mf Gravel, little (-) Organics (wood debris). Moist.	NA						18.9	4.0-5.1' BGS: Slight naphthalene-like odor.
5	0	SW	Discolored black mf SAND, some (-) Organics (wood debris (soft material)), little (-) mf Gravel. Moist to Saturated @ 3.5' BGS.								5.3-5.5' BGS: Black viscous, tacky, stringy tar-like material partially coating sand grains. Moderate naphthalene-like odor.
		SW	Same as above.								
		SW	Discolored black Organics (wood debris), little mf SAND, trace f Gravel. Saturated.	NA						2.8	5.8-6.1' BGS: Black viscous, tacky, stringy tar-like material partially coating sand grains. Moderate naphthalene-like odor.
10	-5	SW/GW	Brown cmf SAND, little mf Gravel, trace Silt. Saturated.								9.0-9.3' BGS: Sporadic sheen visible on sand grains within soil core and on acetate liner.
		SW/GW	Same as above.								
		SP	OUTWASH DEPOSITS	NA						1.3	
			Brown cmf SAND and cmf GRAVEL. Saturated.								
			Brown/red brown mf SAND, trace (-) f Gravel. Saturated.								
15	-10										
20											
25											
30											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY				Permit Number: NA	Boring No. SB-203
					Page 1 of 1	
Inspector/Office BFT/Albany, NY		Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 13.0 ft.
Start/Finish Date 5/8/14 - 5/8/14		Drilling Contractor: ADT, Inc.	Sampling: Macrocore® Hammer Type: NA		Development Method: NA	
Driller: C. Migliore	Drilling Method: Direct-Push	Drilling Equipment: Geoprobe® 7720DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.2 ft.		Easting: 1255335.8 ft. Northing: 219243.6 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SW	Asphalt FILL Discolored black cmf SAND, some (+) mf Gravel (includes coke/coal material), trace Silt. Dry.	NA						1.7	Boring backfilled with bentonite.
		SP	ALLUVIAL DEPOSITS Slightly discolored brown/black mf SAND, little (+) mf Gravel. Moist to Saturated @ 3.0' BGS.	NA						7.2	
5	0	SP									
		SP									
		SW	Slightly discolored brown/black mf SAND, little (+) mf Gravel. Saturated.								
			Discolored black mf SAND, some (+) mf Gravel. Saturated.								
		SW/GP	Brown mf SAND, little f Gravel. Saturated.	NA						1.2	
10	-5		Brown cmf SAND, little (+) f Gravel. Saturated.								
		SP	OUTWASH DEPOSITS Brown cmf SAND and mf GRAVEL, trace (-) Silt. Saturated.								
			Brown mf SAND, trace (-) Gravel. Saturated.								
15											
20											
25											
30											

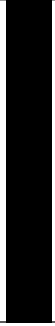
BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY			Permit Number: NA	Boring No. SB-204 Page 1 of 1
Inspector/Office BFT/Albany, NY		Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 9.0 ft.
Start/Finish Date 5/8/14 - 5/8/14		Drilling Contractor: ADT, Inc.		Sampling: Macrocore® Hammer Type: NA	Development Method: NA	
Driller: C. Migliore	Drilling Method: Direct-Push	Drilling Equipment: Geoprobe® 7720DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.1 ft.		Easting: 1255343.1 ft. Northing: 219260.3 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	Asphalt FILL	NA						1.3	Boring backfilled with bentonite. No visible observations or odor indicative of MGP-related materials. 3.0-4.9' BGS: Slight organic-like odor.
		SP	Discolored black mf SAND, some (+) cmf Gravel (includes coke/coal, brick, glass). Dry.								
5	0	SP	Discolored black f SAND, some (-) Silt, little Organics (wood debris), trace f Gravel. Lime-like material @ 3.2' BGS. Moist to Saturated @ 3.8' BGS.	NA						1.6	
		SP	ALLUVIAL DEPOSITS								
		GW/SW	Discolored black ORGANICS (wood debris), little (+) mf SAND. Soft material. Saturated.								
			Brown/grey mf SAND, trace f Gravel. Saturated.								
10			OUTWASH DEPOSITS								
			Grey/brown cmf GRAVEL and cmf SAND. Saturated.								
15											
20											
25											
30											

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY			Permit Number: NA		Boring No. SB-205 Page 1 of 1	
Inspector/Office BFT/Albany, NY		Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA		Slot Size: NA"	Total Boring Depth (ft) 8.0 ft.	
Start/Finish Date 5/8/14 - 5/8/14		Drilling Contractor: ADT, Inc.		Sampling: Macrocore® Hammer Type: NA		Development Method: NA		
Driller: C. Migliore	Drilling Method: Direct-Push	Drilling Equipment: Geoprobe® 7720DT		Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.5 ft.			Easting: 1255346.7 ft. Northing: 219273.2 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			Readings (ppm)	Remarks	
						Sample Int	Recovery	Lithology			Backfill
5	0	SW — SW SW	Asphalt. FILL Discolored black cmf SAND, some (-) mf Gravel (included coal/coke, brick). Moist to Saturated @3.0' BGS. Discolored black cmf SAND, some (-) mf Gravel (included coal/coke, brick). Saturated @3.0' BGS. ALLUVIAL DEPOSITS Discolored black ORGANICS (root matter). Saturated. Brown cmf SAND, little (-) f Gravel. Saturated. Brown cmf SAND, some (+) mf Gravel. Saturated.	NA NA						0.4 0.5	Boring backfilled with bentonite. No visible observations or odor indicative of MGP-related materials. 3.8-4.4' BGS: Slight decomposing organic-like odor.

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY			Permit Number: NA	Boring No. SB-206
				Page 1 of 1	
Inspector/Office BFT/Albany, NY	Checked By: JLM	Borehole Diameter: 3"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 12.0 ft.
Start/Finish Date 5/8/14 - 5/8/14	Drilling Contractor: ADT, Inc.	Sampling: Macrocore® Hammer Type: NA	Development Method: NA		
Driller: C. Migliore	Drilling Method: Direct-Push	Drilling Equipment: Geoprobe® 7720DT	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.6 ft.		Easting: 1255337.8 ft. Northing: 219236.1 ft. TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
5	0	SP	Asphalt FILL	NA						0.4	Boring backfilled with bentonite.
		SP	Brown/discolored black mf SAND, some (+) mf Gravel (includes brick). Dry.	NA						11.7	
		—	Brick (refusal)								
		SP	Discolored black mf SAND, little (+) f Gravel, trace Silt. Moist to Saturated @ 2.9' BGS.								
5			ALLUVIAL DEPOSITS								3.5-4.0' BGS: Black tacky, viscous, stringy tar-like material partially coating wood and sand grains. Moderate naphthalene-like odor. Moderate sheen. 4.0-4.9' BGS: Slight naphthalene-like odor.
		SP	Discolored black ORGANICS (wood debris), some mf SAND. Saturated.								
		SP	Brown mf SAND, little (-) Organics (wood debris). Saturated.	NA						1.4	
		SW/GP	Brown mf SAND. Saturated.								
10	-5		OUTWASH DEPOSITS								
			Brown cmf SAND and mf GRAVEL. Saturated.								
15											
20											
25											
30											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY				Permit Number: NA	Boring No. SB-207
					NA	Page 1 of 1
Inspector/Office BFT/Albany, NY		Checked By: JLM	Borehole Diameter: 8"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 10.0 ft.
Start/Finish Date 5/9/14 - 5/9/14		Drilling Contractor: ADT, Inc.	Sampling: Split Spoon Hammer Type: NA		Development Method: NA	
Driller: C. Migliore	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 85	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 4.8 ft.		Easting: 1255317.1 ft. Northing: 219233.6 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	Asphalt FILL	NA						0.0	Boring backfilled with bentonite.
		SP	Discolored black mf SAND, some (+) cmf Gravel (includes brick, coak/coal, glass). Dry to Moist.								
		SW	Brown/ discolored black mf SAND, little (+) f Gravel. Moist to Saturated @ 3.8' BGS.	1-H-1-H						1.2	
5	0	SW	ALLUVIAL DEPOSITS								
		SP	Black discolored cmf SAND, some (-) Organics (wood debris). Saturated.	2-4-6-4						0.0	4.4-5.0' BGS: Slight naphthalene-like odor. Slight sheen visible on sand grains.
		SP	Black discolored cmf SAND, some (-) Organic (wood debris). Saturated.								5.0-5.2' BGS: Slight naphthalene-like odor.
		SP/GP	Brown mf SAND, little (-) f Gravel. Saturated.	7-6-4-6						0.0	
10	-5	SW/GP	Same as above.								
			OUTWASH DEPOSITS								
			Brown mf SAND and mf GRAVEL. Saturated.								
			Brown/grey mf SAND, little (-) f Gravel. Saturated.								
			Brown/red brown cmf SAND and mf Gravel. Saturated.								
15											
20											
25											
30											

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY			Permit Number: NA	Boring No. SB-208
Inspector/Office BFT/Albany, NY		Checked By: JLM	Borehole Diameter: 8"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 11.0 ft.
Start/Finish Date 5/9/14 - 5/9/14		Drilling Contractor: ADT, Inc.	Sampling: Split Spoon Hammer Type: NA		Development Method: NA	
Driller: C. Migliore	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 85	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 4.9 ft.		Easting: 1255290.9 ft. Northing: 219234.1 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	Asphalt FILL	NA						0.2	Boring backfilled with bentonite.
		SP	Discolored black mf SAND, some (+) mf Gravel (includes coal/coke material). Dry to Saturated @ 3.0' BGS.								
		SP	ALLUVIAL DEPOSITS	1-2-1-4						1.2	3.0-3.7' BGS: Slight organic-like odor.
		SP	Discolored black mf SAND, some (+) Organics (wood debris). Saturated.								4.0-4.1' BGS: Strong organic-like odor.
5	0	SP	Brown mf SAND, little (-) Organic (wood debris). Saturated.	2-4-2-1						9.3	5.0-5.6' BGS: Slight organic-like odor.
		SP	Piece of wood.								5.6-5.8' BGS: Black stringy, tacky tar-like material partially coating sand grains and wood. Strong naphthalene-like odor.
		SW/GW	Brown mf SAND, little (-) Organics (wood debris). Saturated.	6-4-3-4						0.4	
		SW	Discolored black mf SAND and ORGANICS (wood debris). Saturated.	7-4-6-5						0.0	
10	-5		OUTWASH DEPOSITS								
			Brown cmf SAND and cmf GRAVEL. Saturated.								
			Brown cmf SAND, some (-) mf Gravel. Saturated.								
15											
20											
25											
30											

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY			Permit Number: NA	Boring No. SB-209
				Page 1 of 1	
Inspector/Office BFT/Albany, NY	Checked By: JLM	Borehole Diameter: 8"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 11.0 ft.
Start/Finish Date 5/9/14 - 5/9/14	Drilling Contractor: ADT, Inc.	Sampling: Split Spoon Hammer Type: NA	Development Method: NA		
Driller: C. Migliore	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 85	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.2 ft.	Easting: 1255286.4 ft. Northing: 219327.3 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Backfill		
		SP	Asphalt	NA						0.0	Boring backfilled with bentonite.
		SP	FILL								1.1-2.6' BGS: Slight treated wood (wood polish-like) odor
		SP	Brown mf SAND, some (-) cmf Gravel (brick). Dry.								
		SP	Discolored black mf SAND, some (-) cmf Gravel (coal/coak, brick, glass), some Organics (treated wood- possible railroad tie). Dry to Moist.	4-4-2-2						1.2	2.9' BGS: Specs of sheen on surface of water in borehole.
5	0	SP	Discolored black mf GRAVEL, some (-) mf Sand. Moist to Saturated @ 2.9' BGS.	2-4-2-2						0.4	3.0-3.3' BGS: Moderate naphthalene-like odor, moderate sheen on sand grains.
		SP	Discolored black mf GRAVEL, some (-) mf Sand. Saturated.	4-4-4-3						0.3	3.3-3.8' BGS: Slight naphthalene-like odor.
		SP	ALLUVIAL DEPOSITS								
		SP	Discolored black mf SAND, little (-) f Gravel. Saturated.	4-4-5-4						0.5	
10	-5	SP	Dark grey mf SAND. Saturated.								
		SP	Dark grey mf SAND. Saturated.								
		SP	Dark brown mf SAND, some (-) Organic (wood debris), little (+) f Gravel. Saturated. Same as above.								
		SP	OUTWASH DEPOSITS								
		SP	Brown mf SAND, little f Gravel. saturated. Same as above.								
15											
20											
25											
30											

BORING LOG

		Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY			Permit Number: NA		Boring No. SB-210 Page 1 of 1	
Inspector/Office BFT/Albany, NY		Checked By: JLM	Borehole Diameter: 8"	Screen Diameter and Type: NA		Slot Size: NA"	Total Boring Depth (ft) 31.0 ft.	
Start/Finish Date 5/9/14 - 5/9/14		Drilling Contractor: ADT, Inc.		Sampling: Split Spoon Hammer Type: NA		Development Method: NA		
Driller: C. Migliore	Drilling Method: Hollow Stem Auger		Drilling Equipment: CME 85	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.2 ft.			Easting: 1255321.5 ft. Northing: 219257.4 ft. TOC Elev: NA ft.	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology		
5	0		Split-spoon samples not collected. Refer to PASB-41 boring log for description of soils.							<i>Boring backfilled with cement/ bentonite grout. Boring band cleared to 3.5' BGS.</i>
10	-5									
15	-10	SW	Brown/red brown cmf SAND, trace (-) f Gravel. Saturated.	2-3-2-2					0.0	
		SW	Same as above.	3-4-2-2					0.0	
20	-15	SW	Brown cmf SAND. Saturated.	4-4-2-4					0.3	
		SW	Brown cmf SAND. Saturated.	5-6-7-5					0.1	
		SW	Same as above.	7-8-6-7					0.0	
25	-20	SW	Dark brown cmf SAND. Saturated.							
		SW	Brown cmf SAND, little (-) f Gravel. Saturated.	4-4-2-4					0.0	
			No Recovery.	2-4-5-7					--	
30	-25		No. Recovery.	4-2-3-4					--	

BORING LOG

	Project Name: Patchogue Former MGP Site Project Number: 142128 Project Location: Patchogue, NY				Permit Number: NA	Boring No. SB-211 Page 1 of 1
Inspector/Office BFT/Albany, NY	Checked By: JLM	Borehole Diameter: 8"	Screen Diameter and Type: NA	Slot Size: NA"	Total Boring Depth (ft) 11.0 ft.	
Start/Finish Date 5/9/14 - 5/9/14	Drilling Contractor: ADT, Inc.	Sampling: Split Spoon Hammer Type: NA	Development Method: NA			
Driller: C. Migliore	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 85	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.6 ft.	Easting: 1255292.4 ft. Northing: 219222.3 ft. TOC Elev: NA ft.		

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WELL LOG

		Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY			Permit Number: N/A	Well No. MW-10S Page 1 of 1
Inspector/Office AFV/Ramsey, NJ		Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 16.0 ft.
Start/Finish Date 1/22/20 - 1/22/20		Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer	Development Method: Surge + Purge w/Whale Pump: Removed ~25 Gallons		
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --		Easting: -- Northing: -- TOC Elev: --	

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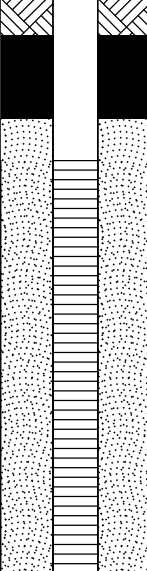
WELL LOG

		Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY		Permit Number: N/A	Well No. MW-10D Page 1 of 1
Inspector/Office AFV/Ramsey, NJ	Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 26.0 ft.
Start/Finish Date 1/22/20 - 1/22/20	Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer	Development Method: Surge + Purge w/Whale Pump: Removed ~30 Gallons		
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Well		
		SP	FILL Black/Brown discolored mf SAND, little Silt, little (-) Organics (wood fragments @0.6'-0.7'+1.10' BGS), trace f Gravel. Dry.	4-5-4-3	1					12.0	0'-13' BGS: Cemente/Bentonite Grout
		SP	Black/Brown discolored mf SAND, little Silt, little mf Gravel. Moist.	4-3-5-4	2					4.5	
		SW	Dark Brown cmf SAND, little (-) mf Gravel, trace Silt. Moist to Wet.	3-3-3-4	3					4.0	
5		SP	Same as above.								
		SW	Black/Brown discolored mf SAND, little Silt. Moist to Wet.	4-5-8-8	4					4.5	4.65'-4.75' BGS: Slight decomposing organic-like odor.
		SP	Brown cmf SAND, little (-) mf Gravel. Wet to Saturated.								
		SW	Black/Brown discolored mf SAND, some Silt, trace f Gravel. Wet to Saturated.	6-6-7-7	5					4.9	6.70'-7.90' BGS: Moderate decomposing organic-like odor.
10		SW	Brown cmf SAND, some mf Gravel. Saturated.								
		SW	Wood.	7-8-10-10	6					4.7	
		SP	OUTWASH DEPOSITS Tan/Brown cmf SAND, little mf Gravel. Saturated.								
		SW	Tan/Brown cmf SAND, trace mf Gravel. Saturated.	10-9-10-9	7					5.9	
		SW	Tan/Brown mf SAND. Saturated.								
15		SW	Brown cmf SAND, some f Gravel. Saturated.	5-5-5-5	8					5.7	13'-15' BGS: Bentonite Seal
		SW	Tan/Brown cmf SAND, little f Gravel. Saturated.	5-6-6-5	9					4.9	15'-26' BGS: Filter Sand
		SW	Same as above.								
		SW	Tan/Brown cmf SAND, trace mf Gravel. Saturated.	6-6-5-5	10					23.9	
20		SW	Tan/Brown cmf SAND, little (-) mf Gravel (concentrated towards the lower half). Saturated.	6-6-6-7	11					22.5	
		SW	Brown cmf SAND, trace mf Gravel. Saturated.								
		SW	Tan/Brown cmf SAND, trace (+) mf Gravel.	7-6-6-7	12					11.2	16'-26' BGS: 0.020" PVC Slotted Screen
25		SW	Tan/Brown cmf SAND, trace f Gravel. Saturated.	6-5-5-5	13					5.6	

WELL LOG

	Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY				Permit Number: N/A	Well No. MW-11S
					Page 1 of 1	
Inspector/Office AFV/Ramsey, NJ	Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 14.0 ft.	
Start/Finish Date 1/21/20 - 1/21/20	Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer	Development Method: Surge + Purge w/Whale Pump: Removed ~20 Gallons			
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Well		
5 10			Split-Spoon samples not collected from 0'-14' BGS. Refer to MW-11D boring for description of soils from this interval.								0'-1' BGS: <i>Cement/Bentonite Grout</i> 1'-3' BGS: <i>Bentonite Seal</i> 3'-14' BGS: <i>Filter Sand</i> 4'-14' BGS: <i>0.020" PVC Slotted Screen</i>

WELL LOG

		Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY		Permit Number: N/A	Well No. MW-11D
		Page 1 of 1			
Inspector/Office AFV/Ramsey, NJ	Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 24.0 ft.
Start/Finish Date 1/21/20 - 1/21/20	Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer	Development Method: Surge + Purge w/Whale Pump: Removed ~35 Gallons		
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Well		
			FILL		0						0'-11' BGS: Cement/Bentonite Grout
			Hand Cleared.								0'-4' BGS: Hand Cleared
5			No recovery - large piece of wood lodged in split-spoon shoe.		1					NA	
		SW	ALLUVIAL DEPOSITS	5-5-8-5	2					2.5	6'-6.95' BGS: Decomposing organic-like odor.
		SW	Dark brown cmf SAND, trace f Gravel. Saturated.								
		SW	Dark brown/black discolored cmf SAND, little mf Gravel. Saturated.	5-6-6-5	3					2.0	8.45'-8.75' BGS: Decomposing organic-like odor.
10			OUTWASH DEPOSITS								
		SW	Orange/Brown cmf SAND, some (+) mf Gravel. Saturated.	6-6-7-6	4					1.5	11'-13' BGS: Bentonite Seal
		SW	Orange/brown cmf SAND, little mf Gravel. Saturated.								
		SW	Orange/Brown cmf SAND, little mf Gravel. Saturated.	5-7-6-8	5					2.0	13'-24' BGS: Filter Sand
		SW	Dark Orange/Brown cmf SAND, trace f Gravel. Saturated.								
15		SW	Orange/Brown cmf SAND, little mf Gravel. Saturated.	7-7-7-8	6					2.1	14'-14.75' BGS: Decomposing organic-like odor.
		SW	Orange/Tan/Brown cmf SAND, trace (-) f Gravel. Saturated.	8-6-8-6	7					2.3	
		SW	Orange/Brown cmf SAND, trace f Gravel. Saturated.	6-5-8-5	8					2.0	14'-24' BGS: 0.020" PVC Slotted Screen
20		SW	Same as above.	7-7-7-8	9					2.6	
		SW	Same as above.	8-7-8-7	10					2.3	

WELL LOG

	Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY				Permit Number: N/A	Well No. MW-12S Page 1 of 1
	Inspector/Office AFV/Ramsey, NJ	Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 14.0 ft.
Start/Finish Date 1/21/20 - 1/21/20	Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer	Development Method: Surge + Purge w/Whale Pump: Removed ~20 Gallons			
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			ppm Readings (ppm)	Remarks	
						Sample Int	Recovery	Lithology			Well
0			Split-Spoon samples not collected from 0'-14' BGS. Refer to MW-12D boring log for description of soils from this interval.								0'-1' BGS: Cement/Bentonite Grout 1'-3' BGS: Bentonite Seal 3'-14' BGS: Filter Sand 4'-14' BGS: 0.020" PVC Slotted Screen

WELL LOG

		Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY		Permit Number: N/A	Well No. MW-12D	
		Page 1 of 1				
Inspector/Office AFV/Ramsey, NJ		Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 24.0 ft.
Start/Finish Date 1/21/20 - 1/21/20		Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer		Development Method: Surge + Purge w/Whale Pump: Removed ~35 Gallons	
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --		Easting: -- Northing: -- TOC Elev: --	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Well		
		SP	FILL Black/Brown discolored mf SAND, little Silt, little (-) mf Gravel. Moist.	6-4-4-5	1					0.0	0'-11' BGS: Cement/Bentonite Grout
		SP	Black/Brown discolored mf SAND, little Silt, little mf Gravel. Moist to Wet.	2-2-2-1	2					1.2	2.0'-2.8' BGS: Moderate decomposing organic-like smell.
5				1-1-2-1	3					NA	
		SP	ALLUVIAL DEPOSITS Black/Brown discolored mf SAND, little Silt, little mf Gravel. Saturated.	3-4-3-3	4					0.8	
		SW	Black/Brown discolored cmf SAND, little mf Gravel. Saturated.	6-7-8-7	5					1.3	
10		SW	OUTWASH DEPOSITS Orange/Brown cmf SAND, trace mf Gravel. Saturated.	5-5-5-5	6					1.6	
		SW	Same as above.	6-5-7-6	7					1.7	11'-13' BGS: Bentonite Seal
		SW	Orange/Brown cmf SAND, little mf Gravel. Saturated.	6-7-7-7	8					3.9	13'-24' BGS: Filter Sand
15		SW	Same as above.	8-6-6-7	9					4.6	14.4' BGS: Black Bristle-like materials within outwash deposits.
		SW	Orange/Brown cmf SAND, trace f Gravel. Saturated.	5-5-5-5	10					4.4	
20		SW	Orange/Brown cmf SAND, trace mf Gravel. Saturated.	4-6-6-7	11					5.1	14'-24' BGS: 0.020" PVC Slotted Screen
		SW	Same as above.	2-3-3-3	12					5.6	

WELL LOG

	Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY				Permit Number: N/A	Well No. MW-13S Page 1 of 1
	Inspector/Office AFV/Ramsey, NJ	Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 14.0 ft.
Start/Finish Date 1/21/20 - 1/21/20	Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer	Development Method: Surge + Purge w/Whale Pump: Removed ~20 Gallons			
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --		Easting: -- Northing: -- TOC Elev: --	

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			ppm Readings (ppm)	Remarks	
						Sample Int	Recovery	Lithology			Well
0			Split-Spoon samples not collected from 0'-14' BGS. Refer to MW-13D boring log for description of soils from this interval.								0'-1' BGS: Cement/Bentonite Grout 1'-3' BGS: Bentonite Seal 3'-14' BGS: Filter Sand 4'-14' BGS: 0.020" PVC Slotted Screen

WELL LOG

	Project Name: Patchogue Former MGP Site Project Number: 153021 Project Location: Patchogue, NY			Permit Number: N/A	Well No. MW-13D
				Page 1 of 1	

Inspector/Office AFV/Ramsey, NJ	Checked By: JLM	Borehole Diameter: 8.25"	Screen Diameter and Type: 2" PVC	Slot Size: 0.020"	Total Boring Depth (ft) 24.0 ft.
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Start/Finish Date 1/20/20 - 1/20/20	Drilling Contractor: Parratt Wolff, Inc.	Sampling: Split Spoon Hammer Type: 140 lb. Auto Hammer	Development Method: Surge + Purge w/Whale Pump: Removed ~35 Gallons
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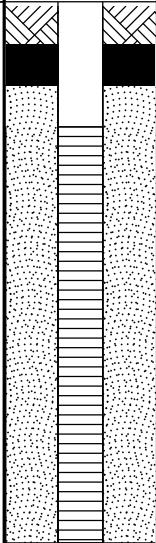
Driller: J. Pace	Drilling Method: Hollow Stem Auger	Drilling Equipment: CME 55	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
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Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log				ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology	Well		
		SP	FILL Dark Brown/Black discolored mf SAND, little Silt, trace f Gravel, trace Organics (wood fibers).	5-5-6-5	1					4.7	0'-11' BGS: Cement/Bentonite Grout
		SP	Tan/Brown mf SAND, little Silt, trace mf Gravel. Moist to Wet.	2-5-5-1	2					7.8	
		SP	ALLUVIAL DEPOSITS	1-2-3-3	3					2.0	4.25'-4.9' BGS: Moderate decomposing organic-like odor.
		SP	Dark Brown/Black discolored mf SAND, little mf Gravel, little Silt, trace Organics (roots/fibers). Moist to Wet.	6-4-3-2	4					8.4	6'-7.5' BGS: Moderate decomposing organic-like odor.
		—	Brown/Tan cm SAND, little Silt, little (-) mf Gravel, little (-) Organics (roots/fibers). Wet to Saturated.	3-3-2-3	5					NA	
		GP	Brown/Tan cm SAND, little (+) mf Gravel, trace Silt, trace Organics (roots/fibers). Saturated. Pieces of brick @6.5' BGS.	4-4-4-4	6					9.0	
		GP	OUTWASH DEPOSITS Orange/Brown mf Gravel, some (+) c Sand. Saturated.	5-6-6-5	7					11.0	11'-13' BGS: Bentonite Seal
		GP	Same as above.	3-2-1-1	8					9.2	13'-24' BGS: Filter Sand
		SP	Orange/Brown cm SAND, little (-) mf Gravel. Saturated.	2-2-2-2	9					11.0	14'-14.83' BGS: Faint to Slight mothball-like odor.
		SW	Orange/Brown c(-)mf SAND, trace f Gravel. Saturated.	5-5-5-5	10					9.5	
		GP	Mf GRAVEL, some Orange/Brown cmf Sand. Saturated.	6-4-6-9	11					9.1	20'-21.05' BGS: Very faint mothball-like odor.
		SW	Orange/Brown cmf SAND, trace f Gravel. Saturated.	4-6-4-6	12					11.5	14'-24' BGS: 0.020" PVC Slotted Screen
		SW	Orange/Brown cmf SAND, trace f Gravel. Saturated								

**Brown AND
Caldwell**

Permit Number:
N/A

Well No. **MW-14S**
Page 1 of 1

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			ppm Readings (ppm)	Remarks
						Sample Int	Recovery	Lithology		
0 1 2 3 4 5 6 7 8 9 10 11 12 13			Split-Spoon samples not collected from 0'-13' BGS. Refer to MW-14D boring log for description of soils from this interval.						0'-1' BGS: <i>Cement/Bentonite Grout</i> 1'-2' BGS: <i>Bentonite Seal</i> 2'-13' BGS: <i>Filter Sand</i> 3'-13' BGS: 0.020" PVC <i>Slotted Screen</i>	

**Brown AND
Caldwell**

Permit Number:
N/A

Well No. **MW-14D**
Page 1 of 1

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			ppm Readings (ppm)	Remarks	
						Sample Int	Recovery	Lithology			Well
0 5 10 15 20		GW	FILL cmf GRAVEL. Wet to Moist.	3-4-4-5	1					1.3	0'-1' BGS: <i>Cement/ Bentonite Grout</i>
		GW	Same as above.	4-4-3-3	2					1.0	1'-10' BGS: Native Backfill 1'-10' BGS: Borehole collapsed during well installation procoess and annular space between borehole and PVC riser filled in with surrounding soils.
		SW	ALLUVIAL DEPOSITS Brown/Tan cmf SAND, little mf Gravel, little Silt. Saturated.	8-6-6-8	3					1.1	
		SW	Light Brown/Tan cmf SAND, little mf Gravel. Saturated.	7-7-8-6	4					1.1	
		SW	Light Brown/Tan cmf SAND, trace mf Gravel. Saturated.	5-6-6-5	5					0.9	
		SW	Brown/Tan cmf SAND, some (+) mf Gravel. Saturated.	7-5-5-5	6					1.0	
		SW	OUTWASH DEPOSITS Orange/Brown cmf SAND. Saturated. Orange/Brown cmf SAND, trace f Gravel. Saturated.	5-4-5-5	7					0.8	
		SW	Orange/Brown cmf SAND, some (-) mf Gravel. Saturated.	4-3-3-3	8					0.8	13'-23' BGS: 0.020" PVC Slotted Screen
		SW	Orange/Brown cmf SAND, trace f Gravel. Saturated.	4-4-3-3	9					0.9	
		SW	Orange/Brown cmf SAND, little (+) mf Gravel. Saturated.	4-4-4-4	10					1.1	
		SW	Orange/Brown cmf SAND, trace f Gravel. Saturated.	2-2-2-1	11					0.7	
			SW	Orange/Brown cmf SAND, little (-) f Gravel. Saturated.	3-4-4-4	12					0.8

APPENDIX D

EXCAVATION WORK PLAN

APPENDIX D – EXCAVATION WORK PLAN (EWP)

This EWP will be implemented to address any intrusive activities that may encounter MGP-related impacted material. The property owner and tenants, consultants, and contractors are required to comply with this EWP. National Grid is only responsible for costs associated with MGP-related impacts. MGP impacted areas are identified in Figure 7, note these areas may not encompass the entire property or tax parcels.

D-1 NOTIFICATION

At least 30 days prior to the start of any intrusive activity on the Site that is anticipated to encounter remaining MGP-related impacts, the Site owner or their representative will notify the NYSDEC. At least 30 days prior to the start of any intrusive activity to be conducted on the Off-Site Property, the Off-Site Property owner or their representative will notify National Grid. If an intrusive activity is to be conducted on the Site or the Off-Site Property that is not anticipated to encounter remaining MGP-related impacts (e.g., previously remediated area that has been restored with clean fill materials), notifications to NYSDEC are not required. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B.

Table 1: Notifications*

Name	Contact Information
Gerald Pratt, NYSDEC Project Manager	(518) 402-9667; gerald.pratt@dec.ny.gov
Jacquelyn Nealon, NYSDOH Public Health	(800) 458-1158 x27880; Jacquelyn.nealon@health.ny.gov
Michael Quinlan, National Grid Project Manager	(516) 220-4363 michael.quinlan@nationalgrid.com

* Note: Notifications are subject to change and will be updated as necessary.

National Grid will generate the notification to NYSDEC via Notice of Intrusion Letter. This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for intrusive activities to be conducted on the Site or the Off-Site Property, re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A detailed description of dewatering, proposed containment of dewatering liquids and planned disposal options for dewatering liquids, if applicable;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's HASP prepared for the specific work that will be performed, in electronic format.;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with required chemical testing results.

D-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a Qualified Environmental Professional contracted by National Grid to oversee invasive activities on the Site and the Off-Site Property during all excavations into known or potentially contaminated material (remaining MGP-related impacts). Soil screening will be performed when invasive work is done and will include excavation and invasive work into known or potentially contaminated material performed during development, such as excavations for foundations and utility work.

Soils excavated within areas where remaining MGP-related impacts may be potentially encountered will be segregated based on previous environmental data and screening results into material that requires off-site disposal at an off-site disposal facility

that is licensed and permitted to accept the type of waste, material that can be returned to the subsurface, and material that can be used as cover soil. Soil potentially suitable for reuse that is stockpiled shall be sampled and analyzed (as described in Section D-7 of this EWP) to evaluate whether material can be (a) reused on the Site or the Off-Site Property; or (b) must be transported to a permitted licensed and permitted off-site disposal facility for treatment and/or disposal.

D-3 SOIL STAGING METHODS

At a minimum, soil stockpiles will be placed on top of polyethylene sheeting or equivalent and continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points. If required by the NYSDEC, the soil stockpiles will be placed within an engineered staging area. Stockpiles will be kept covered with appropriately anchored polyethylene sheeting or equivalent. Stockpiles will be routinely inspected by National Grid's QEP and damaged polyethylene sheeting will be promptly replaced. Stockpiles will be inspected by National Grid's QEP at a minimum once each week and after storm events. Results of inspections will be recorded by National Grid's QEP in a logbook and maintained at the Site and available for inspection by the NYSDEC.

D-4 MATERIALS EXCAVATION AND LOAD-OUT

A QEP contracted by National Grid or person under their supervision will oversee invasive work into known or potentially contaminated material and the excavation and load-out of excavated material generated at the Site and the Off-Site Property.

The owner of the property and the Remedial Party/Respondent solely responsible for safe execution of invasive and other work performed under this EWP.

The presence of utilities and easements will be investigated by the QEP. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the Site or the Off-Site Property.

Loaded vehicles leaving the Site/Off-Site Property will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and other applicable transportation requirements).

The QEP contracted by National Grid will perform checks for compliance with these requirements.

When necessary, a truck wash will be operated on-site. The QEP contracted to National Grid will be responsible for ensuring and documenting that outbound trucks are washed (as necessary) at the truck wash before leaving the Site/Off-Site Property until the intrusive activities into known or potentially impacted materials performed under this section are complete. Truck wash waters will be collected and disposed of at a licensed and permitted off-site disposal facility in an appropriate manner.

Locations where vehicles enter or exit the Site/Off-Site Property shall be inspected daily by National Grid's QEP for evidence of off-site soil tracking. The QEP will document that egress points for truck and equipment transport from the Site/Off-Site Property are clean of dirt and other materials derived from the Site/Off-Site Property during intrusive excavation activities into known or potentially contaminated materials (MGP-related impacts). Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials. National Grid will maintain responsibility for these activities whether associated with the Site or the Off-Site Property.

D-5 MATERIALS TRANSPORT TO PERMITTED OFF-SITE DISPOSAL FACILITIES

Transport of MGP-related impacted material will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. The QEP contracted by National Grid will maintain responsibility for this for activity whether conducted on the Site or the Off-Site Property.

Material transported by trucks exiting the Site/Off-Site Property will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used. The truck transport routes for trucks exiting the Site/Off-Site Property with material destined for off-site treatment and/or disposal are as follows:

- Proceed southwest on West Main Street toward River Avenue;
- Turn right onto Waverly Avenue;

- At the traffic circle, take the first exit and stay on Waverly Avenue;
- Continue onto Patchogue-Holbrook Road;
- Turn left onto Expressway Drive North/Long Island Expressway North Service Road to head towards I-495 West or turn right onto Expressway Drive South/Long Island Expressway South Service Road to head towards I-495 East;
- Proceed to destination.

Trucks loaded with contaminated materials will exit the vicinity of the Site/Off-Site Property using only this approved truck route. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project Site/Off-Site Property. Queuing of trucks will be performed on the Site/Off-Site Property, as practical, in order to minimize off-site disturbance. Off-site queuing will be prohibited.

Egress points for truck and equipment transport from the Site/Off-Site Property will be kept clean of dirt and other materials during the intrusive activities.

D-6 MATERIALS DISPOSAL AT PERMITTED OFF-SITE DISPOSAL FACILITIES

Soil/fill/solid waste excavated and removed from known or potentially MGP-related impacted areas of the Site and the Off-Site Property will be treated as contaminated and regulated material and will be transported and disposed in accordance with local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from the Site/Off-Site Property is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from the Site and the Off-Site Property will not occur without formal NYSDEC or National Grid approval, respectively.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification made to the NYSDEC by National Grid's QEP. This will include

estimated quantities and a breakdown by class of disposal facility if appropriate (i.e., waste disposal facility, treatment facility, construction/demolition recycling facility, etc.). Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report (described in Section 7.7 of the SMP) to be prepared and submitted by National Grid. This documentation will include waste profiles, laboratory analytical test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off of the Site and the Off-Site Property will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

D-7 MATERIALS REUSE ON THE SITE AND THE OFF-SITE PROPERTY

A Request to Import/Reuse Fill or Soil form, which can be found in Appendix E and at <http://www.dec.ny.gov/regulations/67386.html>, will be prepared by the owner and submitted to the NYSDEC project manager by National Grid a minimum of 5 business days for review. This will include analytical sampling of the excavated materials proposed to be used on Site. NYSDEC approval must be received before material is re-used on Site.

Excavated materials outside potentially impacted areas on the Site and the Off-Site Property can be reused for fill on the respective properties, subject to NYSDEC requirements (currently DER-10, Table 5.4(e)4 Reuse of Soil). Excavated soil/fill from the Site/Off-Site Property that is free of visible stains and obvious odors shall be considered potentially suitable for reuse on the respective Site/Off-Site property. Material potentially suitable for reuse shall be placed on polyethylene sheeting. The stockpiled potentially reusable material shall be covered whenever soils are not actively being placed into or removed from the stockpile, during overnight/weekend hours, during periods of precipitation, or whenever dust action levels are exceeded. This material shall be covered using polyethylene sheeting to reduce potential infiltration of precipitation, migration of wind-blown dust, and direct contact exposures.

Stockpiled potentially reusable material from the Site/Off-Site Property shall be sampled and analyzed to evaluate if the material can be used as backfill on the property from which it was excavated or must be transported to a licensed and permitted off-site

disposal. In accordance with DER-10 Table 5.4(e)10, a minimum of one (1) composite sample shall be collected for each 250 cubic yards (CY) of potentially impacted soils and analyzed for TCL semivolatile organic compounds (SVOCs), inorganics, polychlorinated biphenyls (PCBs) and pesticides. In addition, four (4) discrete grab samples will be collected from the 250 CY stockpile and analyzed for VOCs. As indicated in the Generic QAPP included as Appendix G to the SMP, one duplicate sample shall also be collected for every 20 samples, with a minimum of one duplicate per sample delivery group (SDG). Each composite sample shall be formed using individual grab samples collected from five locations within each stockpile (i.e., five discrete grab samples per composite). The composite sample shall be formed by placing equal portions of soil from each of the five discrete grab sampling locations into a pre-cleaned, stainless steel bowl (or dedicated container). Per the Generic Field Sampling Plan (Generic FSP) included as Appendix I to the SMP, the composite sample shall be thoroughly homogenized using a stainless-steel scoop or trowel before being transferred into the sample containers provided by the laboratory. The filled sample containers shall be labeled and transported to the laboratory using a chain-of-custody form. Each sample (composite or grab) will be submitted for laboratory analysis for the constituents listed in Appendix 5 of DER-10. Material suitable for reuse on the Site/Off-Site Property must meet the restricted residential use SCOs in 6NYCRR Part 375-6.

National Grid's Qualified Environmental Professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on the Site/Off-Site Property. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on the Site/Off-Site Property will be placed below the clean soil cap under the demarcation layer on the Site or beneath the impervious surface (asphalt) on the Off-Site Property, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Concrete crushing or processing on-site will not be performed without prior NYSDEC approval on the Site or the approval of National Grid on the Off-Site Property. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site/Off-Site Property will not be reused on-site.

D-8 FLUIDS MANAGEMENT

All impacted liquids to be removed from the Site/Off-Site Property, including but not limited to, excavation dewatering waters, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the Site/Off-Site Property, and will be managed off-site, unless prior approval is obtained by National Grid from the NYSDEC for fluids generated by activities performed on the Site and approval is granted by National Grid for activities performed on the Off-Site Property.

Discharge of water generated during large-scale construction activities to surface waters (i.e., a local pond, stream or river) will be performed under a State Pollution Discharge Elimination System (SPDES) permit obtained by National Grid.

D-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities on the Site or the Off-Site Property, the cover systems will be restored by National Grid. The Site cover systems will s part of the remedy is comprised of a minimum of two feet of clean soil. The cover system on the Off-Site Property is comprised of the building's foundation system and the asphalt pavement. The asphalt pavement cover system includes a demarcation layer (orange-colored non-woven geotextile) as a visual reference to the top of the remaining MGP-related impact zone, that requires adherence to special conditions for disturbance of remaining MGP-related impacted soils defined in this SMP. The asphalt pavement cover system on the Off-Site Property will be restored using the same demarcation layer and asphalt pavement thickness. The demarcation layer will be installed only in areas disturbed by the invasive activities. The property owner shall not change the type of cover system following excavation without prior written permission from National Grid. A figure, to be prepared by National Grid, showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

D-10 BACKFILL FROM OFF-SITE SOURCES

Materials proposed for import onto the Site/Off-Site Property will be approved by National Grid's Qualified Environmental Professional and will be in compliance with provisions in this SMP prior to receipt at the Site/Off-Site Property.

A Request to Import/Reuse Fill or Soil form, which can be found in Appendix E and at <http://www.dec.ny.gov/regulations/67386.html>, will be prepared by the owner and submitted to the NYSDEC project manager by National Grid a minimum of 5 business days for review. This will include analytical sampling of the borrow source or existing documentation of agency approvals of the source (i.e. NYSDOT virgin source certification and latest analytical sampling results). NYSDEC approval must be received before material is imported to the Site.

Imported material shall be sampled in accordance with the frequency requirements presented in Table 5.4(e)10 of NYDEC DER-10. Imported material to be used on the Site/Off-Site Property shall meet the restricted residential use SCOs (6NYCRR Subpart 375-6).

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the Site/Off-Site Property. Imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Soils that meet ‘exempt’ fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for the Site/Off-Site Property, will not be imported onto the Site/Off-Site Property without prior approval by NYSDEC or materials being imported to the Site or by National Grid for materials being imported to the Off-Site Property. Solid waste will not be imported onto the Site/Off-Site Property.

Trucks entering the Site/Off-Site Property with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

D-11 STORMWATER POLLUTION PREVENTION

General stormwater pollution prevention activities will be conducted in support of Site excavation including the following:

- Barriers and hay bale checks will be installed around the entire perimeter of the construction area and will be inspected once a week and after every storm event by National Grid’s QEP. Results of inspections will be recorded in a logbook and maintained at the Site by National Grid’s QEP and available for inspection by the NYSDEC. Necessary repairs shall be made promptly.

- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.
- Undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.
- Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.
- Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.
- Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

All maintenance, monitoring and repairs to the soil erosion and sediment control measures will be performed under the supervision of National Grid's QEP.

D-12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction on the Site or the Off-Site Property, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. by National Grid's QEP as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (target analyte list (TAL) metals; target compound list (TCL) volatiles and semi-volatiles, TCL pesticides and PCBs), unless the history of the Site or the Off-Site Property and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed by National Grid to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive work conducted on the Site or the Off-Site Property will be promptly communicated by phone to NYSDEC's Project Manager by National Grid.

Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline by National Grid. These findings will be also included in the PRR to be prepared by National Grid.

D-13 COMMUNITY AIR MONITORING PLAN

Community air monitoring for VOCs and particulates will be conducted for any intrusive activities at the Site/Off-Site Property when conducting activities in areas with known or potentially impacted soils, in accordance with the CAMP that has been prepared for the proposed work. The CAMP will be prepared in accordance with the NYSDOH Generic CAMP, provided in Appendix F to the SMP. The CAMP will be implemented by National Grid. The quantity and locations of community air monitoring stations will be determined by National Grid's QEP in conjunction with the NYSDOH, based on the size and location of the proposed excavation; however, at a minimum there will be one upwind and one downwind monitoring location. CAMP monitoring data will be recorded by National Grid and included in the project report to be prepared by National Grid. Any exceedances of action levels listed in the CAMP will be reported by National Grid to NYSDEC and NYSDOH Project Managers.

D-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include limiting the areal extent of open excavations, covering excavations with polyethylene sheeting or tarps, etc. If nuisance odors are identified at the Site/Off-Site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until nuisance odors have been abated. NYSDEC and NYSDOH will be notified by National Grid of odor events and of any other complaints about the project. Implementation of odor controls, including the halt of work, is the responsibility of the National Grid's Remediation Engineer, and any measures that are implemented will be discussed in the PRR to be prepared by National Grid.

Necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using

foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to conditions on the Site or the Off-Site.

D-15 DUST CONTROL PLAN

Dust (i.e., particulate) monitoring will be performed in accordance with the CAMP during invasive activities to be conducted on the Site/Off-Site Property in areas of known or potential impacted soils. A dust suppression plan that addresses dust management during invasive activities, will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of hand-held water sprays of a dedicated on-site water truck for road wetting. The truck will be capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

National Grid maintains responsibility to prepare the Dust Control Plan, as necessary.

D-16 OTHER NUISANCES

A plan for rodent and noise control will be developed by National Grid's QEP, as necessary.

APPENDIX E

REQUEST TO IMPORT/REUSE FILL OR SOIL FORM



**NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION**



Request to Import/Reuse Fill or Soil

This form is based on the information required by DER-10, Section 5.4(e). Use of this form is not a substitute for reading the applicable Technical Guidance document.

SECTION 1 – SITE BACKGROUND

The allowable site use is:

Have Ecological Resources been identified?

Is this soil originating from the site?

How many cubic yards of soil will be imported/reused?

If greater than 1000 cubic yards will be imported, enter volume to be imported:

SECTION 2 – MATERIAL OTHER THAN SOIL

Is the material to be imported gravel, rock or stone?

Does it contain less than 10%, by weight, material that would pass a size 80 sieve?

Is this virgin material from a permitted mine or quarry?

Is this material recycled concrete or brick from a DEC registered processing facility?

SECTION 3 - SAMPLING

Provide a brief description of the number and type of samples collected in the space below:

Example Text: 5 discrete samples were collected and analyzed for VOCs. 2 composite samples were collected and analyzed for SVOCs, Inorganics & PCBs/Pesticides.

If the material meets requirements of DER-10 section 5.5 (other material), no chemical testing needed.

SECTION 3 CONT'D - SAMPLING

Provide a brief written summary of the sampling results or attach evaluation tables (compare to DER-10, Appendix 5):

Example Text: Arsenic was detected up to 17 ppm in 1 (of 5) samples; the allowable level is 16 ppm.

If Ecological Resources have been identified use the "If Ecological Resources are Present" column in Appendix 5.

SECTION 4 – SOURCE OF FILL

Name of person providing fill and relationship to the source:

Location where fill was obtained:

Identification of any state or local approvals as a fill source:

If no approvals are available, provide a brief history of the use of the property that is the fill source:

Provide a list of supporting documentation included with this request:

The information provided on this form is accurate and complete.

Signature

Date

Print Name

Firm

APPENDIX F

APPENDIX F-1 HEALTH AND SAFETY PLAN

APPENDIX F-2 GENERIC COMMUNITY AIR MONITORING PLAN

APPENDIX F-1

HEALTH AND SAFETY PLAN

Health and Safety Plan for Post-Remediation Groundwater Monitoring

Patchogue Former MGP Site
234 West Main Street
Village of Patchogue, Suffolk County, NY 11772

May 2022
Revision 16

BC Project Number: 153021

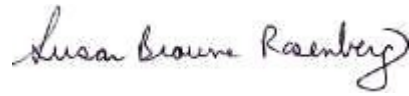
Prepared by:



500 North Franklin Turnpike, Suite 306
Ramsey, New Jersey 07446

Approval Page

This Health and Safety Plan (HASP) has been prepared and reviewed by the following Brown and Caldwell (BC) personnel for use at: **Patchogue Former Manufactured Gas Plant (MGP) Site (BC Project 153021)**

	Name	Signature	Title	Date
Prepared By:	James Marolda		Field Operations Leader	5/13/2022
Reviewed By:	Max Maroney		Site Safety Officer	
Approved By:	Keith Bogatch		Project Manager	
Approved By:	Sarah Everman, CSP		Safety Manager	5/19/2022
Approved By:	Susan Rosenberg, CIH		Certified Industrial Hygienist	5/13/22
Effective Dates:	May 20, 2022 through May 19, 2023			



Limitations: This is a Project-/Site-Specific Health and Safety Plan for exclusive use of Brown and Caldwell (BC). This document shall not be copied or used without the express written consent of a BC Safety Manager (SM). A copy of this document may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards; however, the subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. Subcontractor personnel are expected to comply fully with subcontractor's own HASP and to observe the minimum safety guidelines applicable to their activities that may be identified in BC's HASP. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Revision/Modification Log

Revision No.	Revision Date	Section & Page	Editor	Approver/Date
0	May 2010	New Project	N. Lordan	J. Bucha
1	December 2010	Addition of Quarterly GW Sampling to SOW	C. Trent	J. Bucha
2	June 2011	Addition of Hollow Stem Augers to SOW	C. Trent	J. Bucha
3	August 2011	NG near-miss incident report	C. Trent	J. Bucha
4	April 2012	Addition to SOW – Utility Corridor Work Plan Implementation	C. Trent	J. Bucha
5	June 2013	Deletion of Investigation Activities and Utility Corridor Work Plan Implementation/Annual Update	K. Bogatch	L. Crabtree/ J. Bucha
6	April 2014	Addition of Off-Site Investigation Activities	J. Marolda	--
7	June 2015	Revised schedule for groundwater monitoring and addition of Off-Site Investigation Activities	T. Chaturgan	--
8	December 2016	Update for continuing semi-annual groundwater monitoring activities and deletion of Off-Site Investigation Activities	K. Bogatch/ R. Patel	S. Everman
9	January 2017	Update for Site Remedial Activities	R. Patel	--
10	April 2017	Update for Fencing Installation Activities	E. Beckwith	--
11	June 2018	Update for continuing semi-annual groundwater monitoring activities and oversight of the gas manifold removal	R. Patel	---
12	5/30/19	Revised for Remediation	K. Bogatch	S. Everman (5/31/19)
13	11/13/19	Revised for quarterly groundwater sampling and monitoring well installation	R.Hojnacki	S. Everman (12/31/2020)
14	3/24/20	Addition of Addendum for COVID-19 SOP	R. Patel	--
15	3/11/21	Annual update	J. Marolda	S. Everman/S. Rosenberg (3/17/221
16	5/13/2022	Annual update	J. Marolda	S. Everman/S. Rosenberg (5/19/2022)

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Critical Project Information

Site/Project Information	
Site Location	234 West Main Street Patchogue, New York 11772
Client/Site Contact Michael Quinlan	Cell: (516) 220-4363
BC Project Manager (PM) Keith Bogatch	Office: (201) 574-4765 Cell: (201) 739-2320

Primary Known Compound(s) of Concern:

- Benzene
- Toluene
- Ethylbenzene
- Xylene
- PAHs
- Cyanide
- NAPL/Tar
- Purifier Waste

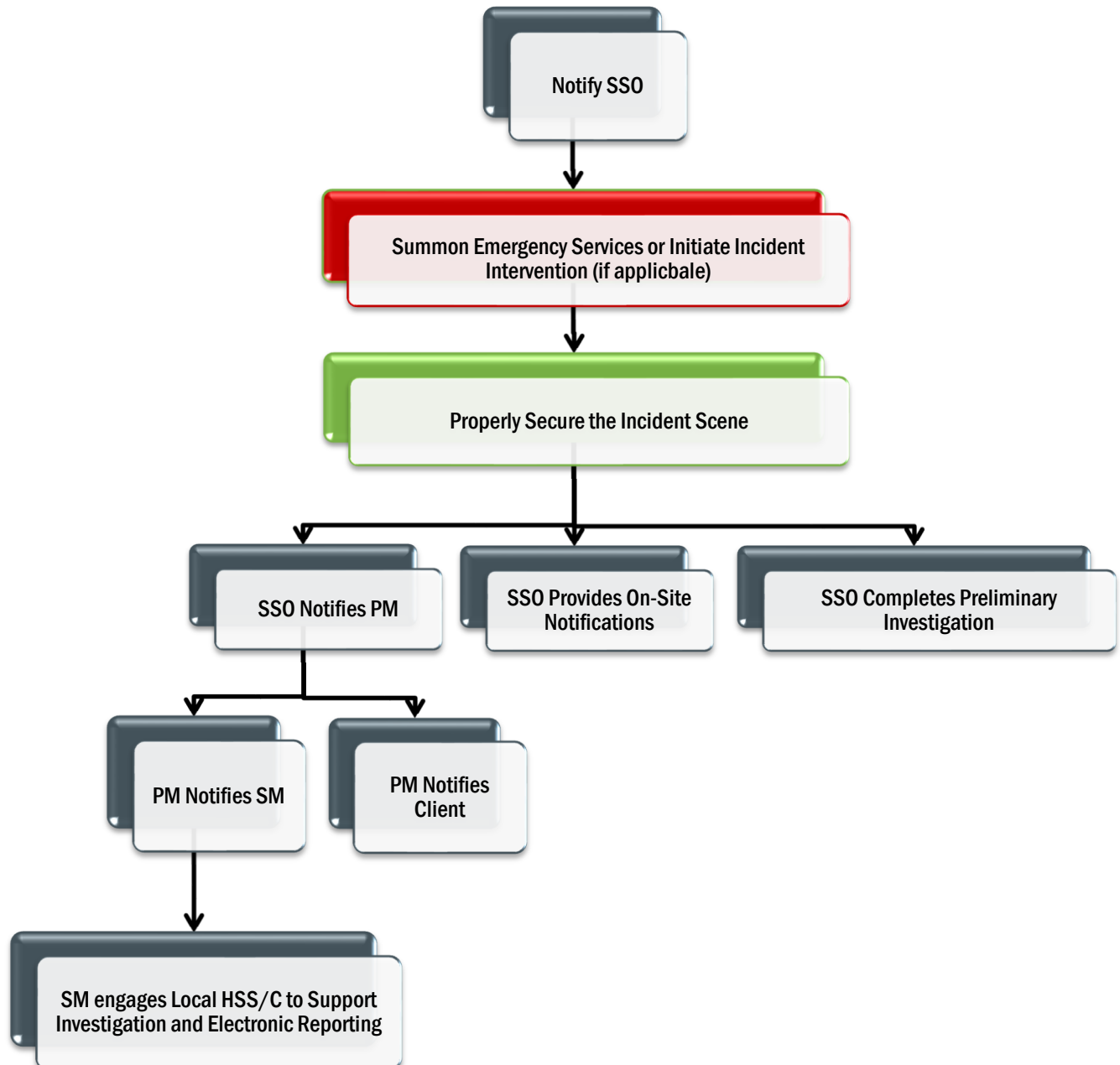
Personal Protective Equipment (PPE) Summary		
Task/ Activity	Required PPE	Required Respiratory Protection
On-site (minimum)	Work shirt and long pants, ASTM-approved steel/safety-toed boots, ANSI-approved safety glasses, ANSI-approved (Class 2 or 3) high visibility vest or outerwear.	None (Level D)
Groundwater Sampling (well opening, water level/NAPL gauging, purging, and sample collection)	On-site minimum + nitrile gloves + sturdy work glove when hand abrasion/puncture a potential.	None (Level D); potential or upgrade to Level C with donning a full-face air purifying respirator with OV cartridge.
If/When overhead hazards are potentially present and/or working in close proximity to heavy equipment	On-site minimum + ANSI-approved hard-hat + other task-specific PPE	None (Level D)

SUBCONTRACTORS		
Company and Primary Company Contact	Contact Information	Site Tasks/Scope
None anticipated for SOW		

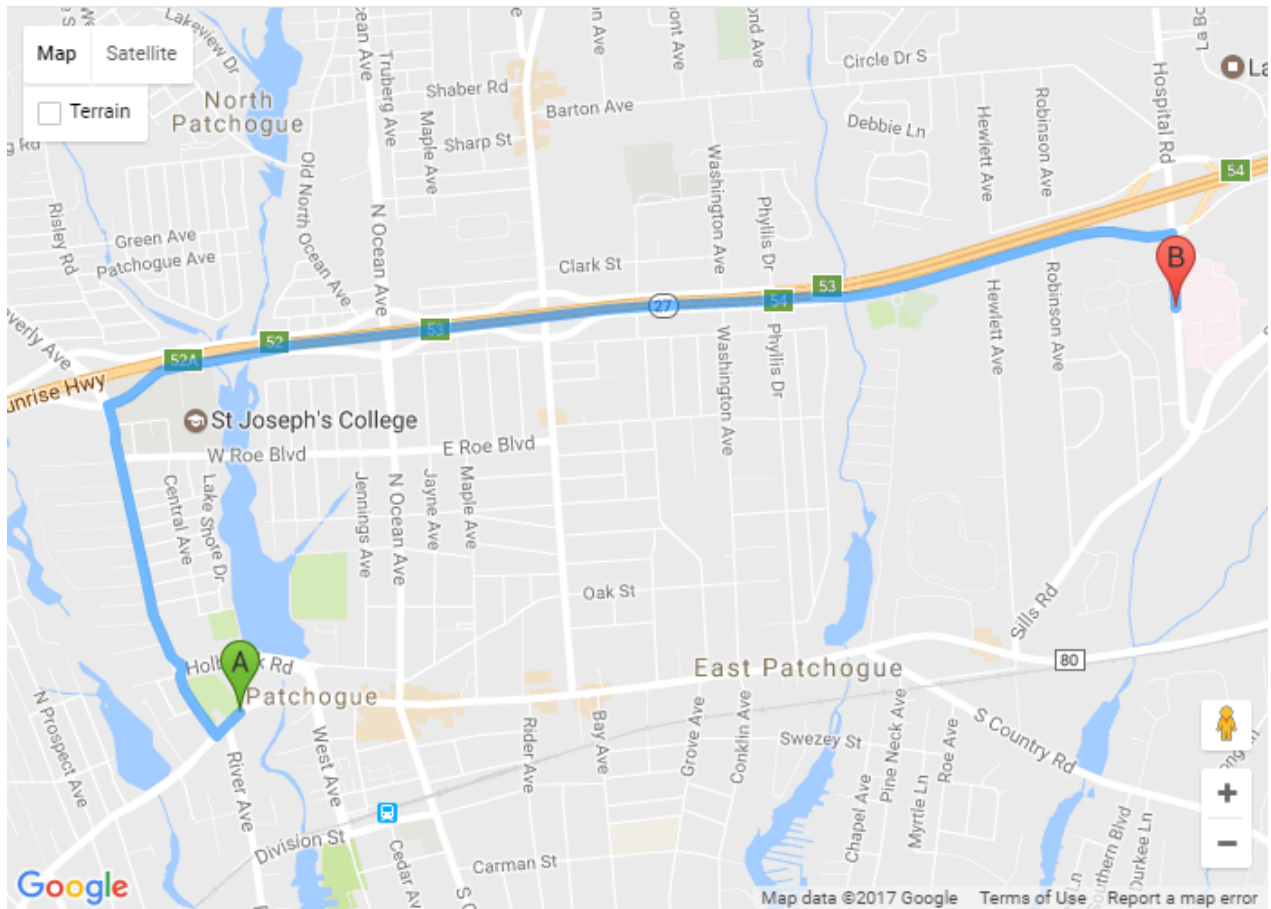
SEE SECTION 10 FOR SITE EMERGENCY CONTINGENCY PROCEDURES*Do not endanger your own life. Survey the situation before taking any action.*

EMERGENCY PHONE NUMBERS	
Emergency Services (Ambulance, Fire, Police)	911
Poison Control	(800) 876-4766 or (800) 222-1222
Incident Intervention (WorkCare)	(888) 449-7787
NYSDEC Spill Hotline	(800) 457-7632
Hospital Name	Brookhaven Memorial Hospital Medical Center
Hospital Address	101 Hospital Road Patchogue, NY 11772
Hospital Phone Number	(631) 654-7100
BC Safety Manager (SM; Sarah Everman, CSP)	Sarah Everman, CSP 615-250-1263 (c) 615-879-9905
BC Site Safety Officer (SSO; Max Maroney)	Cell: (908) 763-1531
BC Electrical Safety Officer (ESO; Eric Campbell)	Office: (206) 749-2223 Cell: (480) 252-2095
BC Corporate Risk Management: Property Loss: Yolanda Harden Injury: Casey Konrai	Office: (925) 210-2494 Office: (925) 210-2228



EMERGENCY NOTIFICATION/INVESTIGATION FLOW-CHART

Hospital Map and Directions



HOSPITAL DIRECTIONS:

Start: 234 West Main Street, Patchogue, NY

1. Head southwest on West Main Street toward River Avenue (430 ft).
2. Turn right onto Waverly Avenue (0.2 mi).
3. At the traffic circle, take the 1st exit and stay on Waverly Avenue (0.7 mi).
4. Turn right onto Sunrise Highway South Service Road (0.4 mi).
5. Take the ramp on the left onto NY-27E (1.3 mi).
6. Take Exit 54 toward Hospital Road/Patchogue (0.2 mi).
7. Merge onto Sunrise Highway South Service Road (0.8 mi).

HOSPITAL INFORMATION:

Brookhaven Memorial Hospital Medical Center
101 Hospital Road
Patchogue, NY 11772

Phone: (631) 654-7100

Est. Travel Distance: 4 miles

Est. Travel Time: 9 minutes

Hospital Map and Directions

8. Turn right onto Hospital Road (0.2 mi).

Destination will be on the left.

Site Emergency Map



-  Emergency meeting location
-  Site entrances and exits
-  Building access points (restrooms available)

EMERGENCY FIRST AID PROCEDURES

THE RESPONDER SHOULD HAVE APPROPRIATE TRAINING TO ADMINISTER FIRST AID OR CPR.

1. Survey the situation. Do not endanger your own life. **DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME. FOLLOW PROTOCOLS INCLUDING THAT A STANDBY PERSON IS PRESENT.** IF APPLICABLE, REVIEW SAFETY DATA SHEETS (SDSs) TO EVALUATE RESPONSE ACTIONS FOR CHEMICAL EXPOSURES.
2. Call 911 (if available) or the fire department **IMMEDIATELY**. Explain the physical injury, chemical exposure, fire, or release.
3. Decontaminate the victim if it can be done without delaying life-saving procedures or causing further injury to the victim.
4. If the victim's condition appears to be non-critical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by the SSO or designated personnel: let the doctor assume the responsibility for determining the severity and extent of the injury. If the condition is obviously serious, contact emergency medical services (EMS) for transport or appropriate actions.

Complete the Preliminary Incident Investigation Form included as Appendix E of this FWSP and submit to SM for review within 24-hour of incident occurrence. Final Incident Report within the Electronic Incident Reporting System must be completed within 72-hour of incident occurrence.

STOP BLEEDING AND CPR GUIDELINES	
To Stop Bleeding	CPR
1. Give medical statement indicating that you are trained in First Aid. 2. Assure: airway, breathing and circulation. 3. Use DIRECT PRESSURE over the wound with clean dressing or your hand (use non-permeable gloves). Direct pressure will control most bleeding. 4. Bleeding from an artery or several injury sites may require DIRECT PRESSURE on a PRESSURE POINT. Use pressure on pressure points for 30 to 60 seconds to help control severe bleeding. 5. Continue primary care and seek medical aid as needed.	1. Give medical statement indicating that you are trained in CPR. 2. Check for responsiveness: Tap shoulders and shout, "Are you OK?" If unresponsive and not breathing: 3. Send someone to call 911 and to obtain an AED and first aid kit (or, if you are alone, complete these actions yourself). It is very important to call for emergency assistance prior to initiating CPR. 4. Open the airway with the person lying on his or her back, tilt head back slightly to lift chin. Check for breathing for no more than 10 seconds. If there is no breathing: 5. Immediately begin CPR, starting with compressions: • COMPRESSIONS: - at least 2 inches deep - rate of 100 to 120 compressions per minute • RESCUE BREATHS: - Open airway: tilt head past neutral position and lift chin. - Pinch nose and form seal over mouth. 6. Continue CPR steps performing compressions and rescue breaths until breathing resumes or emergency services arrive. 7. When AED is available, use it in accordance with the AED instructions. 8. If breathing resumes, maintain an open airway and monitor for any changes in condition.

Section 1

Introduction

It is **Brown and Caldwell's (BC's)** goal to manage projects in a manner that controls the risks associated with recognized workplace hazards and prevent injury or illness to BC project personnel, subcontractors, client personnel and the public, as well as preventing damage to property and/or the environment.

The philosophy and objectives to achieve this goal are:

- The health and safety (H&S) of project personnel is **FIRST** priority.
- Successful project performance can best be achieved if sound H&S practices are an integral part of daily project activities.
- Sound project H&S practices are responsibilities that must be shared equally, without exception, by all personnel working on the project.
- Management and supervisors, including subcontractors, are accountable for the H&S of the personnel for whom they are responsible.
- Each person involved with the project is expected to use common sense and necessary safety precautions to conduct their daily activities in a manner consistent with this policy.

This Health and Safety Plan (HASP) has been developed for use during the **Post-Remediation Groundwater Monitoring** at the **Patchogue Former MGP Site** located at **234 West Main Street, Patchogue, Suffolk County, NY 11772** ("the site"). Activities conducted under BC's direction at the site will be in compliance with applicable Occupational Safety and Health Administration (OSHA) regulations, particularly those in Title 29 of the Code of Federal Regulations, Part 1910.120 (29 CFR 1910.120), and other applicable federal, state, and local laws, regulations, and statutes.

A copy of this HASP will be kept on-site during scheduled field activities. This HASP addresses the identified hazards associated with planned field activities at the site. It presents the minimum H&S requirements for establishing and maintaining a safe working environment during work. In the event of conflicting requirements, the procedures or practices that provide the highest degree of personnel protection will be implemented. If scheduled activities change or if site conditions encountered are found to differ substantially from those anticipated, the Safety Manager (SM) and Project Manager (PM) will be informed immediately upon discovery and appropriate changes will be made to this HASP.

BC's H&S programs and procedures, including medical monitoring, respiratory protection, injury and illness prevention, hazard communication, and personal protective equipment (PPE) are documented in the BC H&S Manual. The BC H&S Manual is readily accessible to BC employees via the BC Pipeline. These H&S procedures are incorporated herein by reference and BC employees will adhere to the procedures specified in the manual.

BC's HASP has been prepared specifically for this project and is intended to address H&S issues solely with respect to the activities of BC's own employees at the site. A copy of BC's HASP may be provided to subcontractors to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's HASP does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of

work and site activities (e.g., operation of a drill rig, excavator, crane or other equipment). Additionally, subcontractors are not to rely on BC's HASP to identify all hazards that may be present at the site.

1.1 Site History

The Site description and history below is as presented in the Final Remedial Investigation Report, Patchogue Former MGP Site (Tetra Tech EC, Inc., December 2009).

The following is a brief summary of operations conducted at the site from 1904 until present based on the available records:

- 1904: Earliest records of site use for coal gasification
- 1904 – 1926: Site owned and operated by Patchogue Gas Company
- 1914: Site converted into a high-pressure gas distribution facility
- 1915 – 1918: Site used to store and distribute high pressure gas produced off-site
- 1922 – 1925: Site used to produce emergency water gas
- 1926: Eight gas aboveground storage tanks (ASTs) installed on-site
- 1976: Long Island Lighting Company sold the site and MGP and gas distribution operations eased. Site sold to third party.
- 1976 – 2006: Site used as a refrigeration-scrap storage yard
- 2005: Site re-acquired by KeySpan
- 2006: KeySpan demolished a warehouse and detached garage
- 2007 – 2018: Performance of Remedial Investigations, Pre-Design Investigations, development of Focused Feasibility Study and Remedial Design
- 2019 – 2020: Implementation of Site Remedy
- 2020 – present: Post-Remediation Groundwater Monitoring

Present: Inactive and vacated site with concrete slabs remaining at the ground surface.

1.2 Site Description

The Patchogue Former MGP Site is located at 234 West Main Street south of Main Street, east of River Avenue, and adjacent to Patchogue River in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York. The site is approximately 3.6 acres with a maximum length (north-south) of approximately 680 feet and a maximum width (east-west) of 180 feet. The average elevation of the site is 10 feet above mean sea level (msl) and the site has a relatively flat topography. The site is located along the Patchogue River just south of where the river exits Patchogue Lake. The site is currently vacant, and the southern area of the property is overgrown with brush and trees. Two concrete slabs are located adjacent to one another in the northern area of the site and are approximately 240 feet by 60 feet in combination. The site is secured by locked perimeter fencing, and private properties border the site.

The site is bordered to the east by the Patchogue River and small industrial properties. The surrounding area is primarily used for commercial and residential purposes. A commercial/industrial area is located north of the site and a residential area lies south of the site. A vacant site formerly occupied by Above All Store Fronts and the Patchogue River border the site to the east, while Costanza Marine Contractors is situated to the west. The River Avenue Elementary School is located approximately one-tenth of a mile southwest and upgradient of the site, with residential homes between the site and the school. The Village of Patchogue's waste water treatment plant (WWTP) is located on the eastern side of the Patchogue River.



1.3 Scope of Work

Brown and Caldwell personnel will be conducting groundwater monitoring and gauging of wells for the presence of non-aqueous phase liquids (NAPL) on a semi-annual basis.

1.3.1 Groundwater Monitoring and NAPL Gauging

Groundwater monitoring events will be conducted at the Site. Each groundwater monitoring event will consist of water level measurements, NAPL gauging, and collection of groundwater samples for laboratory analysis from all available monitoring wells at the time of the sampling. Field activities for each groundwater monitoring event will be conducted by a two-person field crew from BC. Each groundwater monitoring event will be completed in approximately three (3) days. Depth to water measurements and NAPL gauging will be conducted prior to groundwater sampling. In the event that NAPL is detected in a monitoring well during the two groundwater sampling events, a groundwater sample will not be collected from that well.



Section 2

Roles and Responsibilities

Keith Bogatch is the BC Project Manager (PM) and **Sarah Everman, CSP** is the BC Safety Manager (SM). **Max Maroney** has been designated as the BC Site Safety Officer (SSO) for this project. Other critical project team members are identified under the Critical Information Section of this HASP with contact information.

2.1 THINK SHARP: Pause, Think, Go

To prevent mishaps, BC personnel and subcontractors are expected to analyze the risks associated with his/her role and associated activities at the site. A logic tool referenced as **THINK SHARP: Pause, Think, Go** should be utilized to aid project personnel through the risk management process. **THINK SHARP: Pause, Think, Go** requires each person to thoroughly and thoughtfully perform the following before starting each task:

- **PAUSE:**
 - What can go wrong?
 - What are lessons learned from previously performing this task?
 - Do the personnel performing this task have experience?
 - What site conditions or periphery activities could affect safety while performing this task?
- **THINK:**
 - What precautions are needed?
 - What PPE is needed?
 - What tools are needed to perform this work safely?
 - Are the correct tools present to perform the activity (e.g., no “rigging” tools)?
- **GO:**
 - Proceed only when it is determined the task can be performed safely.

If a job cannot be done in a safe manner, it should not be undertaken. It is important for personnel involved with this project to understand that each person has the authority to call a halt to work or activities that have the potential to cause harm to persons, property, or the environment. If an unsafe condition is encountered, each person has the right, responsibility, and obligation to report it without fear of reprisal.

2.2 General Responsibilities

Members of the workforce shall be made aware of their obligation to **stop work** that they consider to be unsafe and that they have the authority, obligation, and responsibility to stop any task or operation where there are concerns or questions regarding the control of the hazards or risks associated with a task or operation that is being performed.



No work will resume until 'Stop Work' concerns or questions have been adequately addressed and associated risks have been eliminated or mitigated to acceptable levels. Instances of work being stopped for reasons of safety shall be recorded, properly investigated, and the results documented, either on the Daily Tailgate Meeting Form (Appendix D) or Incident Investigation Form (Appendix E), as appropriate.

Visitors will be considered personnel that do not meet the minimum requirements to be classified as Field Personnel and shall have controlled access to the work zone (or site if controlled by BC) during active performance of this project's scope of work. It is the responsibility of the SSO to adequately define the applicable work zones (Section 10) along with monitoring and controlling access. Entry into the work zone by a Visitor shall require a H&S briefing from the SSO and donning of minimum on-site PPE by visitor. To enter the exclusion zone, all activities within the zone shall cease and the visitor will be escorted by the SSO or another designated representative.

2.3 Project Management Team

The following are the key management roles and associated responsibilities for this project.

2.3.1 BC Project Manager

The PM is responsible for evaluating hazards anticipated at the site, the scope of work along with being responsible for working with designated field staff, the SSO and the SM to prepare this HASP to address the identified hazards. The PM is also responsible for the following:

- Empowering project team members to implement **THINK SHARP** philosophy.
- Informing project participants of H&S hazards identified at the site.
- Providing a copy of and requiring that each project team field member, including subcontractors, reads or is briefed on the HASP. This shall be documented by individual signatures on the Acknowledgement Form (Appendix C).
- Checking that the BC project team is adequately trained and performing safety briefings in accordance with this HASP.
- Providing the resources necessary for maintaining a safe and healthy work environment for BC personnel.
- Communicating project safety concerns to the SM for determining corrective actions, as applicable.

2.3.2 BC Site Safety Officer

The SSO has on-site responsibility for verifying that BC team members, including subcontractors, comply with the provisions of this HASP. The SSO has the authority to monitor and correct H&S issues as noted on-site. The SSO is responsible for the following:

- Implementing and encouraging the implementation of **THINK SHARP** philosophy.
- Reporting unforeseen or unsafe conditions or work practices at the site to the PM or SM.
- Stopping operations that threaten the H&S of BC field team members, subcontractors, client personnel or members of the surrounding community.
- Monitoring the safety performance of site personnel to evaluate the effectiveness of H&S procedures.



- Performing or verifying the performance of air monitoring, as necessary, as prescribed in this HASP.
- Documenting field team compliance with this HASP by completing the appropriate BC forms contained in the appendices of this document.
- Conducting daily tailgate safety meetings and assuring that project personnel understand the requirements of this HASP (as documented by each BC field team member's signature on the Signature Pages of the Daily Tailgate Form and the HASP Acknowledgement Form).
- Limiting access to BC work areas on the site to BC field team members and authorized personnel.
- Enforcing the "buddy system" or minimum 2-person teams as appropriate for site activities.
- Performing periodic inspections to evaluate safety practices at the site.
- Identifying the location and route to a nearby medical facility with emergency services, identifying emergency contact information, and coordinating appropriate responses in the event of an emergency.

2.3.3 BC Safety Manager

The SM is responsible for final review and modification of this HASP. Modifications to this HASP that result in less protective measures than those specified may not be employed by the PM or SSO without the approval of the SM. In addition, the SM has the following responsibilities:

- Developing and coordinating the overall BC H&S program.
- Advising the PM and SSO on matters relating to H&S on this project/site.
- Recommending appropriate safeguards and procedures.
- Modifying this HASP, if necessary, and approving changes in H&S procedures at the site.

2.4 Field Personnel

BC employees and subcontractors are responsible for familiarizing themselves with H&S aspects of the project and for conducting their activities in a safe manner. This includes attending site briefings, communicating H&S observations and concerns to the SSO, maintaining current medical and training status and maintaining and using proper tools, equipment and PPE. Proper work practices are part of ensuring a safe and healthful working environment. Safe work practices are essential, and it is the responsibility of BC employees and field team members to follow safe work practices when conducting scheduled activities. Safe work practices to be employed during the entire duration of fieldwork include, but are not limited to, the following:

- Implement **THINK SHARP** philosophy.
- Review safety-related information from other parties (e.g., client or contractors) as it relates to BC's activities.
- Inspect PPE before on-site use, using only intact protective clothing and related gear, and changing suits, gloves, etc. if they are damaged or beyond their useful service life.
- Set up, assemble, and check out all equipment and tools for integrity and proper function before starting work activities.
- Assist in evaluating the effectiveness of site procedures (including decontamination) for personnel, PPE, sampling equipment and containers, and heavy equipment and vehicles.



- Practice the “buddy system” as appropriate for site activities.
- Do not use faulty or suspect equipment.
- Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.
- Practice contamination avoidance whenever possible.
- Do not smoke, eat, drink, or apply cosmetics while in chemically affected areas of the site or before proper decontamination.
- Wash hands, face, and arms before taking rest and lunch breaks and before leaving the site at the end of the workday.
- Check in and out with the SSO upon arrival and departure from the site.
- Perform decontamination procedures as specified in this HASP.
- Notify the SSO immediately if there is an incident that causes an injury, illness or property loss. Incidents that could have resulted in injury, illness, or property loss (close-call) will also be reported to the SSO.
- Do not approach or enter an area where a hazardous environment (e.g., oxygen deficiency, toxic or explosive) may exist without employing necessary engineering controls, proper PPE, and appropriate support personnel.
- Use respirators correctly and as required for the site; check the fit of the respirator with a negative or positive pressure test; do not wear respirator with facial hair or other conditions that prevent a face-to-face piece seal.
- Confined spaces will not be entered without appropriate evaluation, equipment, training, and support personnel.



Section 3

Hazard Analysis

Hazards at the site may include physical hazards, chemical hazards or biological hazards. Each type of hazard is briefly addressed in the following section. Hazards that are the specialty of a subcontractor (e.g., operation of a drill rig or excavator) are not addressed in this HASP. Subcontractors are responsible for identifying potential hazards associated with their activities and implementing proper controls.

It is important to note that BC personnel may be exposed to the potential hazards presented below but may not be creating them or be responsible for hazard mitigation or safe operation of equipment that is the responsibility of the client or their contractor(s).

3.1 Hazard Communication

In accordance with the Hazard Communication (HazCom) standard, Safety Data Sheets (SDSs), formerly known as material safety data sheets (MSDSs), will be maintained on-site for chemical products used by BC personnel at the site (e.g., spray paint, cement, diesel, laboratory sample kit preservatives, etc.). Most often, SDSs are incorporated as part of Appendix F of this FWSP. Note that occasionally, prior to bringing a product on-site to a client facility, a copy of the product SDS may need to be provided to obtain approval of use.

Subcontractors will be responsible for maintaining SDSs for chemical products they bring on-site. In addition, containers will be clearly labeled in English to indicate their contents with appropriate hazard warnings. Please note that labeling containers includes, but is not limited to, any waste, used PPE, and/or decontamination materials collected.

3.2 Chemical Hazards

Exposure pathways of concern for chemical compounds that may be present at the site are: inhalation of airborne contaminants, direct skin contact with contaminated materials, and incidental ingestion of affected media. Wearing protective equipment and following decontamination procedures listed in Section 7 can minimize dermal contact and incidental ingestion. To minimize inhalation hazards, dust or vapor control measures will be implemented, where necessary, and action levels will be observed during scheduled activities. Site-specific action levels and air monitoring requirements are presented in Section 5.

Site-Specific Chemicals of Concern			
Known or Suspected Compounds	Source (soil/water/sludge, etc.)	Known Concentration Range Specify (mg/kg, mg/l)	
		Lowest	Highest
Benzene	Soil	Not Detected (ND)	0.0009 mg/kg
	Groundwater	ND	2 ug/l
Toluene	Soil	ND	0.014 mg/kg
	Groundwater	ND	1.3 ug/l

Site-Specific Chemicals of Concern			
Known or Suspected Compounds	Source (soil/water/sludge, etc.)	Known Concentration Range Specify (mg/kg, mg/l)	
		Lowest	Highest
Ethylbenzene	Soil	ND	0.014 mg/kg
	Groundwater	ND	7.3 ug/l
Xylene, Total	Soil	ND	0.006 mg/kg
	Groundwater	ND	9 ug/l
Total Polycyclic Aromatic Hydrocarbons (PAHs)	Soil	ND	145 mg/kg
	Groundwater	ND	333 ug/l
Cyanide, Total (Typically present at MGP sites as iron cyanide complexes)	Soil	ND	3.95 mg/kg
	Groundwater	ND	15 ug/l

Chemical descriptions of select chemicals of concern, including health effects and exposure limits, are presented in the following paragraphs. Each chemical description includes physical and odor recognition characteristics, the health effects associated with exposure, and exposure limits expressed as an 8-hour time-weighted average (TWA). Provided are federal OSHA (OSHA) permissible exposure limits (PELs); (located in 29 CFR 1910.1000); California OSHA (Cal/OSHA) PELs (located in 8 CCR 5155); and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs). For sites outside California, Cal/OSHA PELs are included as an additional reference.

3.2.1 Benzene

Benzene is a clear, volatile liquid. It is colorless, highly flammable, and toxic, with a characteristic odor. It is a severe eye and moderate skin irritant. Human effects by inhalation and ingestion include euphoria, changes in sleep and motor activity, nausea and vomiting, other blood effects, dermatitis, and fever. In industry, inhalation is the primary route of chronic benzene poisoning. If the liquid is aspirated into the lung it may cause pulmonary edema. Poisoning by skin contact has also been reported. Exposure to high concentrations [3,000 parts per million (ppm)] may result in acute poisoning, which is characterized by the narcotic action of benzene on the central nervous system. Chronic poisoning occurs most commonly through inhalation and dermal absorption. Benzene is a confirmed human carcinogen that can cause leukemia.

- The OSHA and Cal/OSHA PEL is listed as 1 ppm and a Short-Term Exposure Limit (STEL) of 5 ppm.
- The ACGIH TLV is listed as 0.5 ppm and 2.5 ppm STEL.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.2.2 Toluene

Toluene is a colorless liquid with a benzol-like odor. Human systemic effects of exposure to toluene include central nervous system changes, hallucinations or distorted perceptions, motor activity changes, psychophysiological changes, and bone marrow changes. It is a severe eye irritant and an experimental teratogen. Inhalation of high vapor concentrations may cause impairment of coordination and reaction time, headaches, nausea, eye irritation, loss of appetite, a bad taste in the mouth, and lassitude.

- The OSHA PEL is listed as 200 ppm with a Ceiling Limit of 300 ppm and a STEL of 500 for 10 minutes.
- The Cal/OSHA PEL is listed as 10 ppm and 150 ppm STEL and Ceiling Limit of 500 ppm.
- The ACGIH TLV is listed as 20 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.2.3 Ethylbenzene

Ethylbenzene is a clear, colorless liquid. It is mildly toxic by inhalation and skin contact. Inhalation can cause eye, sleep, and pulmonary changes. It is an eye and skin irritant at levels as low as 0.1% (1,000 ppm) of the vapor in air. At higher concentrations, it is extremely irritating at first, then can cause dizziness, irritation of the nose and throat, and a sense of constriction in the chest. Exposure to high concentrations of ethylbenzene vapor may result in irritation of the skin and mucous membranes, dizziness, irritation of the nose and throat, and a sense of constriction of the chest.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 5 ppm and 30 ppm STEL.
- The ACGIH TLV is listed as 20 ppm.

3.2.4 Xylene

Xylene is a clear, colorless liquid. It exhibits the general chlorinated hydrocarbon central nervous system effects, olfactory (smell) changes, eye irritation and pulmonary changes. It is a severe skin irritant. There are three isomers: ortho (o-), meta (m-, and para (p-). Exposure to high concentrations of xylene vapor may result in eye and skin irritation. Eye irritation may occur at concentrations of about 200 ppm.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 100 ppm and 150 ppm STEL and Ceiling Limit of 300 ppm.
- The ACGIH TLV is listed as 20 ppm.

3.2.5 Polynuclear Aromatic Hydrocarbons (PAHs)

PAHs constitute a class of materials of which benzo[a]pyrene (BaP) is one of the most common and also the most hazardous. In general, PAHs can be formed in any hydrocarbon combustion process. The less efficient the combustion process, the higher the PAH emission factor is likely to be. The major sources are stationary sources, such as heat and power generation, refuse burning, industrial activity, such as coke ovens, and coal refuse heaps. PAHs may also be released from oil spills. Because of the large number of sources, people are exposed to very low levels of PAHs every day.

Certain PAHs, such as the more common BaP, have been demonstrated to be carcinogenic at relatively high exposure levels in laboratory animals. BaP is a yellowish crystalline solid that consists of five benzene rings joined together. It is highly soluble in fat tissue and has been shown to produce tumors in the stomachs of laboratory mice. In addition, skin cancers have been induced in a variety of animals at very low levels and unspecified lengths of application.

It is important to recognize the PAHs' ability to adhere to soil and other particulates. Therefore, good particulate emission controls and the use of air purifying respirators with particulate filters are required for protection against airborne PAH hazards.

- The OSHA and CAL/OSHA PEL is listed as 0.2 mg/m³ (as coal tar pitch volatiles).



- The ACGIH TLV is listed as 0.2 mg/m³ (coal tar pitch volatiles, as benzene soluble aerosol).

3.2.6 Hydrogen Cyanide

Hydrogen cyanide (HCN) is a colorless or pale blue liquid or gas (above 78° F) with a bitter, almond-like odor. It is a deadly human poison by all routes of exposure. Symptoms of mild exposure include cyanosis, headache, dizziness, unsteadiness of gait, a feeling of suffocation, and nausea. In cases of acute cyanide poisoning, death is extremely rapid (exposure to concentrations of 100 to 200 ppm for periods of up to 60 minutes can cause death).

HCN is a very dangerous fire hazard when exposed to heat, flame, or oxidizers. When heated to decomposition or in reaction with water, steam, or acid, it produces highly toxic fumes of CN⁻.

- The OSHA PEL is listed as 10 ppm (11 mg/m³).
- The CAL/OSHA PEL is listed as 4.7 ppm.
- The ACGIH TLV Ceiling Limit is listed as 4.7 ppm for hydrogen cyanide and 5 mg/m³ as a ceiling level for cyanide salts.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.3 Physical Hazards

The following physical hazards, as marked below, have been identified and may be encountered during scheduled field activities:

- | | | |
|---|---|--|
| ☒ Driving/Vehicle Operation | ☒ Work On or Near Roadways | ☒ Slips, Trips and Falls |
| ☒ Housekeeping | ☒ Noise | ☒ Materials and Equipment Handling or Lifting |
| ☐ Overhead Utilities | ☐ Underground Utilities | ☐ Elevated Platforms/Working Surfaces |
| ☐ Stairway or Ladder Use | ☒ Portable Hand and Power Tools | ☐ Removing/Replacing Manhole Covers |
| ☒ Electrical Hazards | ☐ Energy/System Isolation | ☒ Personal Safety - Violence/Crime Prone Areas |
| ☐ Arc Flash | ☐ Equipment Refueling | ☒ Personal Safety - Forested Areas |
| ☐ Confined Spaces | ☐ Excavations | ☐ Personal Safety - Hunting Areas |
| ☐ Heavy/Mobile Equipment | ☒ Fire/Explosion | ☐ Personal Safety - Shooting Ranges |
| ☐ Drilling | ☒ High-Pressure Hazards | ☒ Preserved Laboratory Sample Kits |
| ☐ ATV or UTV Use | ☒ Working On or Near Water | ☒ Groundwater Sampling |
| ☐ Building Collapse | ☒ Fatigue | ☐ Working at Night |
| ☒ Drum Handling | ☐ Mobile Data Collection | ☐ Other: |
| ☐ Other: | ☐ Other: | ☐ Other: |

Actions to be taken to protect against the hazards identified are provided in the sections below.

3.3.1 Driving/Vehicle Operation

A lot of driving is required to get to, from and between project Sites. Safe vehicle maintenance and operation must be a priority. It requires knowledge of directions to (and conditions of) the Site in advance, careful exiting and merging into traffic, anticipating the unexpected, remaining alert to one's physical and mental condition and contacting assistance when needed.

As a BC policy and a policy for many facilities, cell phones should **not** be used while driving. Additionally, employees may **not** use electronic devices to send/receive text messages, emails, communicate with the internet, program a GPS navigation system, or other similar activities while operating a vehicle. Distracted driving should be avoided when possible. Best practice regarding cell phones and other electronics while driving is to pull over and stop at a safe location to use your cell phone.

While operating a motor vehicle on behalf of BC to/from a Site or while on-Site, personnel are also expected to comply with the following safe practices:

- Driver and all passengers **must** wear seat belts when vehicle is in motion.
- Obey all traffic laws, ordinances, traffic signals and road signs.
- Operate the vehicle in a safe manner and drive within the posted speed limit.
- Do not drive if your vision, hearing or alertness is impaired due to fatigue, illness or any other cause.
- Do not drive while under the influence of alcohol or any other drug, including prescription or over-the-counter medication that may impair the operator.
- As applicable, ensure loads are properly secured and do not exceed the vehicle manufacturer's specifications and legal limits.
- Attempt to pull-through or back-in when parking unless otherwise restricted.
- Perform a vehicle walk-around prior to pulling forward or backing out when parked for extended periods.
- Use horn to notify those nearby that vehicle is about to move forward. Note that some facilities have specific number of "honks" depending on the direction a vehicle would be moving.
- Chock parked vehicles is recommended and required for some facilities.

Report all vehicle collisions/incidents to BC's Property Loss Risk Manager and contact your SM regarding additional incident reporting requirements.

3.3.2 Housekeeping

Personnel shall maintain a clean and orderly work environment. Keep aisles and passageways clear and in good repair to provide free and safe movement of employees and material-handling equipment. Make sure that all materials stored in tiers are stacked, racked, blocked, interlocked or secured to prevent sliding, falling, collapse or overturning. Do not allow materials to accumulate to a degree that it creates a safety or fire hazard.

During construction activities, scrap and form lumber with protruding nails and other items shall be kept clear from work areas, passageways and stairs. Combustible scrap and debris shall be removed at regular intervals. Safe means must be provided to facilitate removal of debris.

Containers must be provided for collecting and separating waste, used rags and other debris. Containers used for garbage and other oily flammable or hazardous waste such as caustics, acids,



harmless dusts, etc., must be separated and equipped with covers. Garbage and other waste shall be disposed of at frequent and regular intervals.

3.3.3 Electrical Hazards

Electrical hazards may be present at the Site in various forms and the BC Electrical Safety Officer (ESO) should be contacted for additional information or to appropriately plan for hazard mitigation beyond those identified for the common situations identified here-in. If concerns are identified in the field, the BC Electrical Safety Officer should be notified immediately.

Extension Cords

Extension cords may not be used as a permanent means of providing power and will be removed from service if they are worn, frayed, or if the grounding prong is missing.

Extension cord precautions include the following:

- Be aware of exposed or bare wires, especially on metal grating. **Warning:** Electrical contact with metal can cause fatal electrocution.
- Prior to use, inspect cords for exposed or bare wires, worn or frayed cords, and incorrect splices. Splices are permitted, but there must be insulation equal to the cable, including flexibility.
- Cables and extension cords in passageways, steps or any area where there may be foot traffic should be secured to not create a tripping hazard. Overhead cables and extension cords shall be rigged to a height greater than 6 feet.
- Shield extension cords that must run across driveways or areas where vehicle traffic is present.
- Do not run cords across doorways or windows where they can be frayed or cut by a closed door or window.
- Do not run wires through wet or puddled areas.
- Flexible cord sets that are used on construction Sites or in damp locations shall be of hard usage or extra hard usage type.

Temporary Grounding

For portable generators greater than 5 kilowatt (kW), refer to the operator's manual for grounding requirements. When temporary grounding is required, a ground rod or listed grounding wire cable clamp must be utilized. Minimum ground rod requirements are 5/8" Φ x 10', must be driven perpendicular to the surface, and should be considered disposable after installation (unlikely to be able to be removed).

Portable generator manufacturers have different operational requirements, so it is prudent to review the owner's/operations manual prior to renting or transporting to a remote field location.

3.3.4 Work On or Near Roadways

Vehicular traffic presents opportunities for serious injury to persons or property and is considered a project hazard not only when BC or our subcontractors are working along or within road Right-of-Ways (RoWs) but also when conducting activities in facility parking lots, alleyways and access roads.

All work on, or adjacent to, existing public and jobsite roadways shall be performed in conformance to site requirements and applicable jurisdiction requirements. Refer to the current U.S. Federal Highway Administration Manual on Uniform Traffic Control Devices for guidelines. Where required, an approved

Traffic Control Plan (TCP) shall be developed and proper permits obtained. Additionally, when activities are conducted within any roadway, whether minor or major road, a barricade vehicle or other barricade device must be in-place prior to proceeding with activities. This include when there is the potential for support equipment/support to encroach within this area.

The following good operating practices will be implemented, at a minimum, when working in or near traffic areas in addition to the aforementioned requirements:

- Site personnel will wear ANSI Class 3 high-visibility traffic safety vests or outerwear whenever activities are conducted in areas of heavy traffic. Note some activities and clients may require vest or outerwear to meet ANSI Class 3 criteria, such as when working at night or along major roadways (such as highway or interstate).
- **Never turn your Back on Traffic.** When working in or near a roadway, walk and work with your face to the oncoming traffic. If you must turn your back to traffic, have a coworker watch oncoming traffic for you.
- Consider using amber/yellow warning lights to alert traffic to the work zone. Note that amber/yellow warning lights may be required by specific clients or ordinances and should be utilized when conducting windshield surveys along major roadways where BC or subcontractor vehicles would have stop/go operations.
- It is important to be conscious of all vehicular traffic that may be present while conducting field operations. Use caution tape, barricades, or safety cones to denote the boundaries of the work area and to alert vehicle operators to the presence of operations, which are non-routine to them. Be careful when exiting the work area and especially when walking out from between parked vehicles to avoid vehicular traffic. Note this includes working within the RoW, not only while conducting activities in the roadway.
- As previously stated, if required by local ordinances or if work will be conducted along a major roadway, a Traffic Control Plan (TCP) will be developed by a qualified and competent person. This TCP will be incorporated as part of this H&S Plan as an attachment and implemented accordingly. If professional flagging will be required as part of this TCP, then an appropriate company will be subcontracted to perform services.
- **Vehicle and Positioning.** Whenever possible, place a vehicle between your work area and oncoming traffic when working within the row. Not only is the vehicle a large, visible warning sign, but also if an oncoming car should fail to yield or deviate, the parked vehicle, rather than your body, would absorb the first impact of a crash. Turn the wheels so that if the vehicle were struck, it would swing away from the area of work. Even though the vehicle would protect you in a crash, it might be knocked several feet backward. Always leave some room between the rear of the vehicle and the work area.
- **Use of Signs and Cones to Direct Traffic.** Traffic signs and cones are used to inform drivers and direct traffic away from and around you. Cones and signs are only effective if they give oncoming drivers enough time to react and make it clear how traffic should react. The most common coning situation is setting a taper of cones that creates a visual barrier for oncoming motorists and gradually closes a lane. The position of the taper depends on the road width, position and size of the work area, and on the characteristics of the traffic.

3.3.5 Noise

Noise may result primarily from the operation of heavy equipment, process machinery or other mechanical equipment. Hearing protection with a Noise Reduction Rating (NRR) of 28 or above shall be



worn in areas with high noise levels. A good rule of thumb to determine if hearing protection is needed is the inability to have a conversation at arm's length (3 feet) without raising voice levels or if noise is greater than 85 decibels. If loud noise is present or normal conversation becomes difficult, hearing protection in the form of earplugs, or equivalent, will be required.

3.3.6 Portable Hand and Power Tools

Personnel may be required to use hand and power tools to perform a task in the field, including cutting activities. While performing these activities on active construction Sites, except where more stringent requirements may exist, all hand and power tool operations shall be in accordance with OSHA 29 CFR 1926 Subpart I.

Cutting Utensils

Frequently, field tasks require the cutting of items such as rope, packaging or other containers. Care should be exercised in using knives and/or cutting implements while performing such cutting tasks. Note that many facilities ban the use of open blades such as knives or box-cutters and the use of these type of tools are generally discouraged. The following are general safe practices regarding the use of cutting utensils:

- Use utensils that have a safety blade holder with a retraction spring on a track where blade mounts with a hook type blade which has a reduced cutting edge. When the hook of the blade is cutting the object, it keeps the blade extended. If the blade breaks or the operator's hand slips the blade automatically retracts into the handle of the safety blade holder.
- Replace blades when they become dull. If material becomes hard to cut, then the blade is dull.
- Wear cut-resistant (such as Kevlar) gloves and safety glasses.
- Personnel should cut down and away from their body and other personnel.
- The item being cut should be braced or secured from movement while cutting.
- If you drop the knife or other cutting utensil, just let it fall to the ground and DO NOT try to catch it.
- If you lay the knife or other cutting utensil down, make sure the blade is retracted into the holder or the knife or other utensil is placed in a protective holder.

General Safe Practices for Hand and Power Tools

The following are general safe practice regarding the use of hand and power tools:

- All hand and power tools shall be visually inspected by the user prior to use for any defects. Tools with defects shall not be used and tagged out of service.
- Personnel shall only use tools for which they have been trained and in accordance with manufacturer requirements.
- Tools should only be used for the task for which the tool has been designed.
- Power tools shall not be used if safety equipment such as shields, tool rests, hoods, and guards have been removed or otherwise rendered inoperative.
- Employees using tools under conditions that expose them to risk of flying objects, harmful dusts, and/or noise shall be provided with the required additional PPE to complete the task such as hearing protection, respirator and/or face shield.

- All electrically powered tools shall be properly grounded. Outlets for 110-volt tools shall be protected by ground fault circuit interruption devices whenever used in outdoor or wet environments. Double-insulated electrical hand tools are required.
- Portable grinders will be provided with hood-type guards with side enclosures that cover the spindle and at least 50% of the wheel. All wheels will be inspected regularly for signs of fracture, have a ring test performed and check that wheels are rated for the grinder's RPM.
- Hoses supplying pneumatic tools shall have couplings secured to prevent accidental disconnection. "Push, twist, click" locking connection disconnects shall be used. Where those cam lock connectors are not used, a safety pin and whip check must be utilized. Quick disconnects larger than 3/4-inch inside diameter must have safety pins and whip cables attached to the hose, pipe connection and between connected hoses, unless automatic shutoff valves are used. Whip checks are required for air hoses 3/4-inch or larger.
- Air supply lines will be protected from damage, inspected regularly and maintained in good condition. Air sources supplying hoses exceeding 1/2-inch ID shall be protected by excess flow valves to prevent whipping in the event of hose separation or failure.
- The pressure of compressed air used for cleaning purposes will be reduced to 30 psi or less (this does not apply to cleaning of forms, etc.). Hose extensions always will be used. At no time shall compressed air be directed toward a person.

3.3.7 Equipment Refueling

Care shall be exercised while refueling generators, pumps, vehicles and other equipment to prevent fire and spills. Personnel shall eliminate static electricity by grounding themselves (touching metal) prior to using refueling hoses and or containers of petroleum liquids. Items being refueled shall be grounded or be located on the ground and not on a trailer, workbench or inside a truck bed. Equipment that is hot must be allowed to cool prior to refueling. Spill response materials shall be available when conducting refueling operations.

3.3.8 High-Pressure Hazards

Personnel may be exposed to high-pressure scenarios while performing work at this Site. High-pressure exposure may come from, but not be limited to, ruptures in pressurized lines/pipes, use of pressurized equipment (i.e. cleaning equipment), when working with compressed gas, or even develop in normally non-pressured vessels (i.e. volatilization in sealed waste drum).

Direct exposure to high-pressure streams may cause lacerations, burns, loss of eyesight, infections from water and/or debris trapped beneath the skin, or even the loss of an appendage. Additional injuries could also be inflicted from whiplash from a broke pressurized line.

Drummed/Sealed VOC Waste:

If high VOC concentrations are present and/or drums or other sealed containers are stored in direct sun, due to volatilization the vessel may become pressurized. Prior to moving, sealed drums should be inspected for signs that the drum is under-pressure, such as bulging. If determined to be under-pressure, care should be taken to ensure pressure is relieved before opening or removing. A face shield should be utilized while relieving the pressure in addition to appropriate gloves and/or outerwear for chemical exposure (Section 4). Refer to Drum Handling for additional information regarding safe drum handling procedures.

Compressed Gas Cylinders:



Compressed gases are stored in steel cylinders, typically at an initial pressure about 2,000-lb./sq. in. (136 atm or 138 bar) above normal atmospheric pressure. These steel cylinders must be stored and handled safely. Careful practices are essential. The potential of a serious problem exists if an incident does occur with a compressed gas cylinder.

The U.S Department of Transportation has established regulations for the Labeling of compressed gas cylinders. The contents of a cylinder must be determined prior to use. No Label should be defaced, missing, or obscured in any manner. A cylinder whose Label fits one of the preceding descriptions shall not be used but returned to the supplier.

The valves must be protected, and the cylinders must be secured when they are stored or moved. Cylinders should be strapped to a firm support. The valve protection cap shall be kept on until the cylinder is secured in place and ready for use. Cylinders shall only be moved with a suitable hand brake truck. They should never be rolled or dragged. They should never be subjected to a flame or be allowed to be a part of an electrical circuit. Cylinders and valves are equipped with various safety devices such as a fusible plug that melts at about 70°C (158°F). Under no circumstances may safety devices be tampered with.

Blasts of compressed gases for such purposes as blowing away dust should not be employed; the moving particles can cause harm.

Cylinders of hazardous gases shall be kept in such a manner that they do not contaminate breathing air. All cylinders shall be stored in the in the Lab or an appropriate storage location. The location will have the approval of the LM.

Used cylinders shall be capped and tagged with the appropriate “empty” tag. The date and initials of the individual transferring the cylinder to empty stock shall be placed on the “empty” tag.

The following represents a summary of safety factors relevant to compressed gas cylinders:

- Keep cylinders away from heat.
- Replace the protective cap prior to moving the cylinder and before disconnecting the security straps or chains.
- Any cylinder that is moved shall be strapped onto a cart designed for moving cylinders, and the cap must be attached.
- Use a chain, strap, or similar device to secure cylinders in an upright position. Only after this has been completed shall the protective caps be removed.
- Regulators, tubing or fittings contaminated by oil, grease, or chemicals shall not be used.
- Full cylinders shall be stored in the designated storage space.

Pressurized Hoses:

Pressurized hoses may be used at the Site to run tools like air knives and pressure washers. While the tools they power can make a worker's job much easier, the hoses themselves can be dangerous if handled improperly. The hoses derive power from the liquid or gas that moves inside them; however, that power also creates a reactive force. If the force is strong enough, it can cause the hose to whip, possibly causing serious injury if it strikes a worker and property damage.

The following tips can help prevent hose whipping hazards:

- Inspect hoses for torn outer jackets, damaged inner reinforcing or soft spots before using them. Hoses with these types of damage should be removed from service.



- Reduce the pressure in the hose to a lower level if possible. Setting pressure regulators to 30 psi or less can minimize the possibility of the hose whipping.
- Restrain pressurized hoses that are unavoidably located near other employees with guards that are strong enough to keep the hoses in place if a leak or rupture occurs.
- Use solid lines with tight fittings if possible instead of flexible hoses when working near other employees. Solid lines do not whip or leak as readily as flexible hoses, which can develop leaks from vibration, pressure cycles and aging.
- Examine the connections on pressurized hoses frequently to prevent any accidental detachment of the line, which would result in uncontrollable whipping. Hose clamps with a restraining chain should be used to minimize the whipping effect if hose connections should accidentally become loose.
- Never connect or disconnect pressurized hoses, always depressurize first.
- Don't stop the airflow in a hose by bending or crimping with pliers as this could cause major hose damage.

3.3.9 Working On or Near Water

Working on or in close proximity to water bodies (e.g. streams, ponds, etc.) presents many hazards to field personnel that can range from uneven or slick terrain, potentially dangerous water levels/currents, entrapment from sloughing ground, chemical/sewage exposure to electrocution. Accidentally falling into a water-body could result in physical injuries, hypothermia and in severe cases drowning. Remember that a person can drown in as little as 2-inches of water. Risks should always be assessed for the scope to be implemented in relation to additional hazards present by completed tasks on, in or in close proximity to water prior to proceeding with activities. While working over or near water on active construction Sites, except where more stringent requirements may exist, activities shall be conducted in accordance with 29 CFR 1926.106.

General Safe Practices for Working Around Water-bodies

- Prior to commencing work, the task should be evaluated for associated hazards posed by the water and at a minimum an emergency response plan for a water-related emergency, such as worker falling into the water, high-currents or wave action or inclement weather, should be developed. Keep water rescue equipment easily accessible.
- Keep rescue and emergency equipment close and easily accessible, not more than 200-feet away from the work area.
- Know the water depth, subsurface conditions and ground conditions before you begin work along a bank or within the water-body (i.e., stream walk, sampling, etc.).
- Keep equipment a safe distance back from the water's edge.
- Under no circumstances will personnel enter water bodies without protective clothing (i.e., rubber boots, waders, wet suit, etc.).
- Avoid traveling over ice covered water and make sure you have spare clothing available to address the potential of hypothermia if someone falls into the water during the winter or cooler weather conditions.
- Where the potential of drowning exists, personnel shall be provided a US Coast Guard (USCG)-approved life jacket or buoyant work vest (also known as personal floatation devices [PFDs]). It

is recommended to don such PPE in when working within 6-feet of a water-body 3-feet or deeper.

- Prior to and after each use, PFDs shall be inspected for defects which would alter their strength or buoyancy, with defective items removed from service.
- Where possible erect barricades or warning devices such as traffic cones, plastic fencing or caution tape to prevent access and/or serve as a warning system if a worker unintentionally approaches the water body.

Streams/Storm Water Conveyances

Personnel may need to work along or within streams, creeks, small rivers or storm water conveyances as part of Site activities. These features may be located near freeways and highways that present additional hazards and the hazard description for working on or near roadways should be reviewed. Additionally, these features may have high flows or strong currents under normal conditions or following storm events that present a threat to workers. Work in and around streams will require the use of the buddy system for safety purposes. Prior to entering water, employees must evaluate the need to wear PFDs, rubber boots or waders and use them as is deemed necessary based on conditions presented. Some factors to consider when evaluating the need to wear a PFD are stream current speed, streambed material (e.g. slippery stones vs. small gravel/sand), water depth and how far out from the bank the employee will be required to go into the stream. When walking in the stream, efforts will be made to walk in the shallow and/or slower moving parts of the stream whenever possible.

During storm events that cause streams and rivers to rise to dangerously high conditions, employees should discontinue their work until safe working conditions resume. When precipitation falls in the area, water levels within the stream may change quickly. Rising water levels may be dangerous. All personnel should exit the stream once wet weather has occurred in the area. If the forecast calls for rain, the group should meet and discuss alternative activities that may be planned for the day. After a rain, the SSO must evaluate field conditions and halt fieldwork if there is the possibility of the development of a hazardous condition.

Open Water/Wetlands

Personnel may need to work along or in ponds, lagoons, lakes or bay/harbors and occasionally wetlands (natural or constructed) as part of Site activities. Often wetlands, ponds or lagoons are associated with wastewater facilities and may contain pre- or post-treated wastewater or serve as part of the treatment process which present additional biological or chemical hazards. Activities sometimes also include accessing drained ponds to address sludge and/or sediment accumulation which present hazards such as entrapment or muscle strain based on the nature of the material that usually lacks the capabilities to fully support personnel or equipment.

Work on, in or around open water bodies, including wetlands, will require the use of the buddy system for safety purposes. It is recommended that when personnel are working within the water body that at least one person remains on shore for emergency response if needed and it is recommended that radio communication be considered if unable to communicate verbally otherwise.

When working within 6-feet of an open water body where water depth is 3-feet or greater, excluding wetlands, the donning of a PFD will be included as part of the minimum PPE for site activities with the need for donning rubber boots or waders will be evaluated based conditions presented. Though open water bodies are less likely to be immediately impacted during storm events, stop work conditions for each Site should be determined prior to commencing activities and account for not only rising water

levels but also influence of other storm event factors such as wind which may create unsafe work conditions through choppy or rough waters.

3.3.10 Fatigue

Fatigue is an acute, ongoing state of tiredness that leads to mental and physical exhaustion and prevents people from functioning within normal boundaries. It is more than feeling tired and drowsy, it is a physical condition that can occur when a person's physical or mental limits are reached. Signs of fatigue include tiredness even after sleep, psychological disturbances, loss of energy and inability to concentrate. Fatigue can affect the ability to communicate clearly, work safely and productively and react optimally in an emergency situation. Additionally, fatigue and related consequences can be significant contributing factors in incidents.

Fatigue can occur as a result of various factors that may be work-related, lifestyle related or a combination of both. Work factors can include the work task, work scheduling and planning and environmental conditions. Lifestyle factors can include inadequate or poor quality of sleep due to sleep disorders, social life, secondary employment, travel time, health and wellbeing.

Everyone in the workplace has a responsibility to help ensure fatigue does not pose a H&S risk at work. If an employee is experiencing fatigue or notices a co-worker exhibiting signs of fatigue, he or she should contact the PM or SSO to discuss alternative work arrangements. The following signs or symptoms may indicate a co-worker is fatigued:

- Excessive yawning or falling asleep at work
- Short-term memory problems and an inability to concentrate
- Noticeably reduced capacity to engage in effective interpersonal communication
- Impaired decision-making and judgment
- Reduced hand-eye coordination or slow reflexes
- Other changes in behavior, for example repeatedly arriving late for work
- Increased rates of unplanned absence

Personnel must take reasonable care for their own health both at work and during off hours to prevent workplace fatigue. It is the responsibility of each field personnel to communicate their field work commitments to their supervisor and other PMs to ensure that work assignments are appropriately managed to reduce the potential of creating worker fatigue.

3.3.11 Slip, Trips and Falls

Slipping hazards may exist due to uneven terrain, wet or slick surfaces, leaks or spills. Tripping hazards may be present from elevation changes, debris, poor housekeeping or tools and equipment. Some specific hazards may include climbing/descending ladders, scaffolding, berms or curbing. Collectively, injuries from these types of hazards account for nearly 50 percent of all occupational injuries.

Prevention requires attention and alertness on the part of each worker, situational awareness of their surroundings, following and enforcing proper procedures that include good housekeeping practices and wearing appropriate footwear for the terrain. If personnel are working within a congested area or in rough terrain, effort should be made to establish a clear, safe walking path or access way to/from the work area involving the engagement of Client personnel or other Site contractors, if necessary.

3.3.12 Materials and Equipment Handling or Lifting

The movement and handling of equipment and materials on-Site or when preparing to mobilize/demobilize from a Site pose a risk to workers in the form of muscle strains and minor injuries. These injuries can be avoided by using safe handling practices, proper lifting techniques and proper personal protective equipment such as steel-toed boots and sturdy work gloves. Where practical, mechanical devices will be utilized to assist in the movement of equipment and materials. Workers will not attempt to move heavy objects by themselves without using appropriate mechanical aids such as drum dollies, carts or hydraulic lift gates. Personnel are discouraged from carrying loads over 50 pounds without employing the buddy system or utilizing mechanical equipment for assistance.

Prior to lifting and/or carrying a load, personnel are encouraged to plan for the lift by first identifying if an alternative to lifting is available (buddy system, mechanical assistance, etc.) and if the lifting is determined necessary, follow proper lifting techniques. Proper lifting techniques include, but are not limited to, the following:

- Face the object squarely and get as close to it as you can.
- Lift with the strength of your knees, not your back.
- Firmly plant your feet approximately shoulder-width apart.
- Turn your whole body, do not bend or twist at the waist.
- Be sure that the path is clear of obstructions or tripping hazards; avoid carrying objects that will obstruct your vision.
- Use caution when holding an object from the bottom to prevent crushing of the hands or fingers when lowering.
- Lower the object in the reverse of way you picked it up, keeping your back straight, tightening your abdomen, and bending at the knees.
- Whenever possible, store heavy loads off the floor.
- Don't twist your body when lifting or setting an object down.

3.3.13 Personal Safety – Violence/Crime Prone Areas

Working in a distressed neighborhood may present hazards associated with street violence or other crime. In these situations, mental preparation before going to the Site and awareness while on Site are of key importance. If in doubt, always ask Site or client personnel about the safety of a neighborhood. Forethought should be given to arranging to work during daylight hours if possible. Take advantage of any Site security measures (monitoring cameras, security guards) and investigate such measures prior to the fieldwork. Once in the field, work in parties of two or more and stay within view of the public. Keep a charged cell phone nearby or on your person at all times. Become familiar with your location so you can effectively communicate it over the phone.

In addition to these basic principles, the following is a list of common personal safety rules that apply not only to work at the Site, but to general safety practices while in the field and also between work shifts:

- If possible, work/travel in groups. Do not venture out alone.
- Be alert. Notice who passes you and who is behind you. Maintain distance between yourself and strangers. Know where you are and note potential exit paths.
- If work has paused, do not appear slack or distracted. Do not sit in a vehicle with the doors unlocked.



- Walk in well-lighted areas. Do not walk close to bushes, alleys, and so on. In dark or deserted neighborhoods, walk down the middle of the street (be alert to vehicle traffic).
- If a car pulls up slowly, or the occupants of the vehicle bother you, cross the street and walk or run in the other direction. If you are pursued, dial 911.
- If you feel someone is following you, turn around and check. Proceed to the nearest lighted house or place of business.
- Do not overburden yourself with bags or packages, which might impede running or taking care of yourself.
- Be aware of loose clothing, packs/purses and hair. These give an assailant an easier method of grabbing and controlling you. Wear unrestrictive clothing for ease of movement (but not overly loose).
- Carry a non-weapon personal safety device (such as a whistle, panic button, or key light) - anything that could visually or audibly draw attention to your location.
- What you carry in your hand(s) is important. Valuables make you a potential target. Items such as a hand auger or tool may help you be perceived as a less-than-inviting victim.
- Carry as little cash as possible.
- Hold your purse tightly, close to your body. Keep your wallet in a front or in a buttoned, hip pocket. When at a fixed location, lock your valuable items away and out of Site (i.e., in a trunk).
- Be careful when people stop you for directions or information. Always reply from a distance; never get too close to a stranger's car.
- If you feel that you are in danger, do not be afraid to scream and run.
- Toss wallet/keys away from direction of escape.
- Do not attach car keys to house keys.
- Leave large valuables (e.g. purse, laptop) locked and hidden in the vehicle.

3.3.14 Personal Safety – Forested Areas

Working in a forested environment may present unique hazards related to the region and terrain including special biological hazards. Refer to Section 3.5 for details regarding biological hazards identified for this Site.

Basic safety rules regarding working in a forest or heavily wooded area include:

- Wear appropriate clothing for the trail conditions and season. See additional safety information included in the Personal Safety – Hunting Areas hazard description
- Wear sturdy shoes with textured soles and ankle supports.
- Use a walking stick to assist with identifying dips, moving vegetation from the path, etc.
- Think about your footing. Stay on developed trails or dry, solid rock areas with good footing. Trees and bushes, especially near the edge of cliffs, can't be trusted to hold you.
- Be alert for slippery areas and take your time to avoid tripping. Low-hanging branches and variable terrains make running unsafe, and leaves can hide slippery areas underneath.
- Be alert for "widowmakers". OSHA describes widowmakers as, "broken off limbs that are hanging freely in a tree to be felled or in trees close by." The detached or broken limb or treetop is often caught in lower branches of the tree or a nearby tree and may become dislodged if the



supporting branches suddenly give way or due to high winds. Personnel are encouraged to examine trees surrounding the work zone and proactively identify the presence of widowmakers. Generally, widowmakers must be knocked down or pull down with a machine. If widowmakers cannot be safely removed, avoid working underneath the branches.

3.3.15 Preserved Laboratory Sample Kits

When environmental media samples are collected, some laboratory analyses require the addition of preservative in the sample bottle prior to receipt. Personnel should be aware of the potential for preservative (HCL, sulfuric acid, nitric acid, etc.) to leak during shipment. When opening laboratory kit coolers/boxes, personnel should exercise caution to minimize splash potential and wear appropriate PPE, which would include, at a minimum, nitrile gloves and safety glasses. If leakage is observed, the shipping container or cooler should be appropriately cleaned and/or discarded. Additionally, personnel should notify the respective laboratory about the leakage and request that preventative measures be implemented to minimize potential for leakage moving forward.

3.3.16 Drum Handling

Drum handling presents numerous serious physical hazards including back injury, crushing, bruising, laceration, and trauma from mishandling. Drum contents may represent a fire or explosion hazard or may also be pressurized or be acutely toxic/corrosive. Drum handling may, therefore, represent both physical and chemical hazards. A Site-specific drum handling protocol should be developed and followed prior to initiating drum handling activities on-Site.

Appropriate procedures for handling drums varies depending on the drum contents. Prior to handling, drums labels should be noted visually to identify their contents and the drums should be inspected for the following helpful information:

- Signs of deterioration such as corrosion, rust and leaks.
- Indications that the drum is under pressure, such as bulging.
- Configuration of the drumhead. For example, if the whole lid of the drum can be removed, then it was designed to contain solid material; if the lid has a bung, then the drum was intended for liquids. If the drumhead contains a liner, the drum may contain highly corrosive or otherwise hazardous materials.
- Noting the type of drum in conjunction with its label also may be useful for identifying potential hazards in unusual storage conditions. Polyethylene or PVC-lined drums often contain strong acids or bases. If the lining is punctured, the substance usually quickly corrodes the steel, and may cause a significant leak or spill. Exotic metal drums (e.g., aluminum, nickel, stainless steel) are very strong and expensive, and are often used to store extremely dangerous materials. Single-walled drums used as a pressure vessel have fittings for both the storage product and for an inert gas. These drums may contain reactive, flammable, or explosive substances.

To avoid incidents, drums should only be handled when necessary. In all phases of handling, personnel should be alert for new information about potential hazards and should respond to new hazards before continuing with routine handling operations. The following procedures can be used to maximize worker safety during drum handling and movement:

- Only personnel fully qualified to handle waste drums will be used (often a specialty subcontractor).
- Train personnel in proper lifting and moving techniques.

- Personnel should wear appropriate PPE for the hazard, which at minimum, will include steel-toed boots, safety glasses and gloves to protect against the potential contaminant (as defined in this safety plan).
- Personnel should not lift or move the drum alone. Get help or use a drum dolly.
- When using a drum dolly; make sure the dolly is appropriate for the task; the drum is properly closed, loaded and secured to the dolly; and the pathway is clear of obstructions.
- Drums and containers that cannot be moved without rupture, leakage or spillage should be emptied into a sound container using a device classified for the material being transferred.

3.3.17 Groundwater Sampling

Sampling approach for the collection of groundwater samples from monitoring and/or extraction wells varies based on multiple factors that may include depth, diameter, volume of groundwater produced and local state requirements. Anticipated sampling equipment may include, but not be limited to, bailers, inertial pumps (foot-valves), submersible pumps (plastic or stainless steel), peristaltic/suction pumps, bladder pumps and piston/pneumatic pumps. It should be noted that BC personnel conducting groundwater-sampling activities may not only be exposed to hazards associated with sample pump operation but also laboratory kit and purge water handling.

The operation of pumps, including the installation/removal and accessing work-area, include the following potential hazards:

- Back strain from carrying equipment to/from work-area.
- Back strain from lifting/lowering the device within a well. It should be noted that the deeper the well the more effort would be spent removing the device.
- Repetitive motion injury from sampling large number of wells/locations and/or bailing larger diameter or deep wells.
- Electrical shock potential from operating pump from battery, car or generator.
- Back strain from moving support equipment to operate pumps such as compressed gas cylinders or generators.
- Chemical exposure from impacted groundwater potentially splashing or spilling between discharge point and sample or purge container.
- Chemical exposure from removing equipment from well following sampling.
- High-pressure exposure from broken/ruptured compressed gas line (bladder or pneumatic pumps).
- Chemical exposure and possible ignition of gasoline used to power generators (from filling up gas canisters to filling up generator; submersible pumps).
- Possible burn from handling overheated pumps - consider using cooling shroud, if appropriate. (submersible pumps).
- Potential burns or property damage from possible battery leakage.
- Potential encounters with stinging insects or spiders in outer protective casing.
- Injuries from cutting tubing/string or using tools to open casing covers/lids.
- Tripping over cords, tubing, string, etc.

Personnel performing groundwater-sampling activities should be familiar with the type of pump used and be trained in the appropriate operation of respective device. Additionally, selection of pump should not only take into consideration technical project requirements but also environmental conditions (e.g., carry only access, intrinsically safe, etc.). The following are tips to help minimize hazard exposure during groundwater sampling pump operation:

- Practice proper lifting techniques. **Where practical, mechanical means should be utilized to assist in the movement of equipment and materials. Do not attempt to lift by bending forward. Bend your hips and knees to squat down to your load, keep it close to your body, and straighten your legs to lift. Avoid turning or twisting your body while lifting or holding a heavy object. Refer to Equipment and Materials Handling or Lifting Hazard for additional information.**
- Consider the well area and access when setting up workspace to avoid creating additional slip, trip and fall hazards. Maintain good housekeeping.
- **Utilize carts, gators or dollies when loading equipment into a vehicle and/or moving equipment and/or industrially derived waste (IDW) around the Site.**
- Utilize hose or cord reels and/or winches when possible.
- Consider wearing sturdy work gloves with chemically protective glove to protect hands from scrapes or punctures when carrying equipment and/or lowering/removing the equipment from wells.
- Remember to consider pinch-points when connecting and disconnecting sampling/pump equipment.
- When connecting pump cables to a battery (portable or car), always connect the red (positive) cables first and do not touch the metal clamps.
- Inspect all equipment components such as lines, wires, straps or cases for damage and wear and tear that could cause sharp edges, electrical failure, pump failure or failure of the case while carrying.
- Appropriately ground electrical equipment and utilize GFCIs where applicable. If unsure how to ground selected equipment, personnel should consult the equipment vendor and/or the BC ESO. Refer to Electrical Hazards for additional guidance in relation to temporary grounding.
- Use caution when refueling and running generators. Refer to Equipment Refueling Hazard for additional information.
- Portable batteries should be self-contained and/or placed in a cooler to assist with transport and to provide secondary containment if battery corrodes and leaks. Between each use, battery should be inspected for possible corrosion and replaced as applicable.
- If operating electrical pumps during rain or snow events, batteries should not be placed directly on the wet ground surface and should be covered. Similar protection should be provided to pump controllers. If using a generator, check vendor operating procedures to determine if and how to operate equipment in such conditions.
- If utilizing compressed gas cylinders to operate pump equipment, refer to High Pressure Hazards for additional hazard information and guidance.
- If requirement to move/manage IDW drums while on-site, refer to the Drum Handling Hazard for additional guidance.

- Additionally, be aware of biological hazards while opening stick up or flush mount protective casings and be prepared for exposure prior to approaching well. Refer to Biological Hazards for additional information regarding potential biological hazards identified for this Site.

3.4 Natural Phenomena

Natural phenomena such as weather-related emergencies and acts of nature can affect employees' safety. Natural phenomena can occur with little or no warning. If an emergency situation arises as a result of natural phenomena, adhere to the contingency procedures outlined in Section 10.

The following natural phenomena have been identified and may be encountered during scheduled field activities:

- | | | |
|---|---|--|
| ☒ Sunburn | ☒ Heat Stress | ☒ Cold Stress |
| ☒ Lightning/Electrical Storms | ☒ Hurricanes/Nor' Easters | ☐ Tornados and Strong/Straight Line Winds |
| ☐ Earthquakes | ☒ Flooding | ☒ Snow/Freezing Rain |
| ☐ Other: | | |

Actions to be taken to protect against the hazards identified are provided in the sections below.

3.4.1 Sunburn

Working outdoors with the skin unprotected for extended periods can cause sunburn to the skin. Excessive exposure to sunlight is associated with the development of skin cancer. Field staff should take precautions to prevent sunburn by using sunscreen lotion and/or wearing hats and long-sleeved garments.

3.4.2 Heat Stress

Climate conditions, particularly heat, are important considerations in planning and conducting Site operations. Heat-related illnesses range from heat fatigue to heat stroke, with heat stroke being the most serious condition. Workers should be trained and aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions, summarized in the table below. The SSO and Site workers will monitor each other for signs of heat stress. If an employee exhibits signs or symptoms of heat-related illness, the SSO or designee must be notified, and the appropriate response procedures initiated.

Heat Related Illness			
Condition	Signs	Symptoms	Response
Heat Rash or Prickly Heat	Red rash on skin.	Intense itching and inflammation.	Increase fluid intake and observe affected worker.
Heat Cramps	Heavy sweating, lack of muscle coordination.	Muscle spasms, and pain in hands, feet, or abdomen.	Increase fluid uptake and rest periods. Closely observe affected worker for more serious symptoms.
Heat Exhaustion	Heavy sweating; pale, cool, moist skin; lack of coordination; fainting.	Weakness, headache, dizziness, nausea.	Remove worker to a cool, shady area. Administer fluids and allow worker to rest until fully recovered. Increase rest periods and closely observe worker for additional signs of heat exhaustion. If symptoms of heat exhaustion recur, treat as above and release worker from the day's activities after he/she has fully recovered.

Heat Related Illness			
Condition	Signs	Symptoms	Response
Heat Stroke	Red, hot, dry skin; disorientation; unconsciousness	Lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse.	Immediately contact emergency medical services by dialing emergency medical services. Remove the victim to a cool, shady location and observe for signs of shock. Attempt to comfort and cool the victim by administering small amounts of cool water (if conscious), loosening clothing, and placing cool compresses at locations where major arteries occur close to the body's surface (neck, underarms, and groin areas). Carefully follow instructions given by emergency medical services until help arrives.

The effects of ambient temperature can cause physical discomfort, loss of efficiency, personal injury and can increase the probability of mishaps. Protective clothing that decreases the body's ventilation can be an important factor leading to heat-related illnesses.

To reduce the potential for heat-related illness, workers are encouraged to drink plenty of water/fluids to stay properly hydrated. In addition, a work schedule will be established that will provide sufficient rest periods for cooling down (at least five minutes when workers feel the need to do so) and have access to shade from the sun (which, in addition to natural shade or canopies, includes resting inside a vehicle with the air conditioner running). **Personnel must maintain an adequate supply of non-caffeinated drinking fluids on Site for personal hydration – a minimum of one quart of water per employee per hour.**

3.4.3 Cold Stress

Workers performing activities during winter and spring months may encounter extremely cold temperatures, as well as conditions of snow and ice, making activities in the field difficult. Adequate cold weather gear, especially head and footwear, is required under these conditions. Workers should be aware of signs and symptoms of hypothermia and frostbite, as well as first aid for these conditions. These are summarized in the table below.

Cold Stress Symptoms and Response			
Condition	Signs	Symptoms	Response
Hypothermia	Confusion, slurred speech, slow movement.	Sleepiness, confusion, warm feeling.	Remove subject to a non-exposed, warm area, such as truck cab; give warm fluids; warm body core; remove outer and wet clothing and wrap torso in blankets with hot water bottle or other heat source. Get medical attention immediately.
Frostbite	Reddish area on skin, frozen skin.	Numbness or lack of feeling on exposed skin.	Place affected extremity in warm, not hot, water, or wrap in warm towels. Get medical attention.
Trench Foot	Swelling and/or blisters of the feet	Tingling/itching sensation; burning; pain in the feet	Remove wet/constrictive clothing and shoes. Gently dry and warm feet with slight elevation. Seek medical attention.

3.4.4 Lightning/Electrical Storms

Lightning can be unpredictable and may strike many miles in front of, or behind, a thunderstorm. Workers will therefore cease field operations at the first sign of a thunderstorm and suspend activities until **at least 30 minutes after the last observed occurrence of lightning or thunder.** For purposes of this HASP, signs of a thunderstorm will include any visible lightning or audible thunder.

In the event of a thunderstorm, field personnel will take the following actions:

- Get inside a permanent building structure (not a shed or canopy) or fully enclosed metal vehicle (not a convertible or camper shell) with the windows fully up.
- If in a house or building, do not use the telephone or any electrical appliance that is connected to the building's electrical wiring.
- Stay away from tall isolated objects, such as trees, drill rigs, telephone poles, or flagpoles.
- Avoid large open areas, such as fields or parking lots, where a person is the relatively highest object.
- Stay away from lakes, ponds, railroad tracks, fences, and other objects that could transmit current from a distant lightning strike.
- If caught out in the open without time to escape or find shelter, seek a low area (if time permits), crouch down, and bend forward holding the ankles. Tuck the head so that it is not the highest part of the body, without letting it touch the ground. Under no circumstances lay down.

If a person is struck by lightning contact emergency medical services, even if he/she appears only stunned or otherwise unhurt as medical attention may still be needed. Check for burns, especially at fingers and toes, and areas next to buckles and jewelry.

3.4.5 Hurricanes/Nor' Easters

The key to responding to hurricane conditions is being informed. Before taking to the roads to leave for or from a jobsite during suspect hurricane conditions, listen to the radio for current and forecast conditions. Know what the weather reports mean by "watch" and "warning." A hurricane watch means hurricane conditions are possible in the specified area of the watch, usually within 36 hours. A hurricane warning indicates hurricane conditions are expected in the specified area of the warning, usually within 24 hours.

If watch or warning conditions exist, employees will communicate with the project manager to determine the appropriate course of action. Travel to or from work is not recommended if the employee will travel near a hurricane warning area. Restrictions on travel during hurricane watches are largely dependent on the actual weather conditions at the time. Employees are discouraged from driving during weather conditions where visibility and vehicle control are severely limited.

Nor'easters have the potential to cause as much damage as hurricanes, with powerful winds, rain or snow and large waves. They can pound and erode beaches with heavy surf, affect inland areas with flooding, or coat the land with thick layers of ice and snow.

Nor'easters result from the counterclockwise rotation of a low-pressure system and the clockwise rotation of a high-pressure system, combining to bring wind and moisture to the northeast. The nor'easter's ferocity will depend on the strength of the two systems.

One reason nor'easters are so dangerous is that they tend to move much more slowly than hurricanes. That slow movement allows the storm's effects to accumulate in an area.

A nor'easter's wind circulation can cause tidal waters in back bays to be held in place, and not allow the water to drain through inlets into the ocean. The accumulation of more and more water in tidal areas can cause widespread flooding.

Nor'easters can occur all year long but are primarily a risk between September and April.

In the event of a hurricane or nor'easter, be prepared by:



- Checking NOAA Weather Radio All Hazards, your local radio and TV stations (i.e., The Weather Channel) for updates, watches, warnings or emergency instructions.
- Know the Coastal Evacuation Route for coastal areas or an inland area with chronic flooding.

For long term projects with temporary or permanent offices, keep an emergency preparedness kit consisting of, but not limited to:

- Current project/office contacts list – (how to reach folks in an emergency),
- Blankets,
- Flashlights,
- Radio (operated by batteries),
- Batteries for flashlight and radio (note: batteries should be replaced annually to assure freshness),
- Water (unless there is a water bubbler that can be used with no electricity), and
- Snack crackers, dried fruit, etc. - a source of food that will not go bad.

3.4.6 Tornadoes and Strong/Straight Line Winds

Tornadoes and strong or straight-line winds are potentially dangerous weather conditions because both can generate on very short notice (in some cases under one hour from clear weather conditions).

Tornadoes and strong or straight-line winds both have the same warning properties and recommendations. If a tornado “watch” is issued for your area, it means that a tornado is “possible”. If a tornado “warning” is issued, it means that a tornado has been spotted, or is strongly indicated on radar, and it is time to go to a safe shelter immediately.

Be alert to what is happening outside, but do not place yourself in jeopardy by standing next to windows. Some common observations during a tornado include: a sickly greenish or greenish-black color to the sky; if there is a watch or warning announced or posted; an abrupt fall of hail (however, hail can occur in the absence of a tornado); a strange quiet that occurs within or shortly after a thunderstorm; clouds moving by very fast, especially in a rotating pattern or converging toward one area of the sky; a sound like a waterfall or rushing air at first, but turning into a roar as it comes closer (the sound of a tornado has been likened to that of both railroad trains and jets); debris dropping from the sky; an obvious “funnel-shaped” cloud that is rotating; or debris such as branches or leaves being pulled upwards, even if no funnel cloud is visible.

During a tornado warning or tornado occurrence, each employee is instructed to do the following:

- Proceed to interior rooms and halls on the lowest floor (do not use an elevator to exit an upper floor). Avoid halls that open to the outside in any direction. If there are no interior hallways, avoid those that open to the southwest, south, or west, since that is usually the direction from which the tornado will come.
- Stay away from glass, both windows and doors. Crouch down and make as small a “target” as possible. If you have something with which to cover your head, do so, otherwise, use your hands.
- Exercise extreme caution when leaving your area of shelter. Be aware of potential hazards (i.e., natural gas smell, smoke, fire). In the event these hazards are encountered in your area of shelter, immediately evacuate the shelter. If the building/shelter has been damaged by a tornado, do not flush the toilets, as the sewer lines may have been damaged.

- If you are traveling in an automobile and can see a tornado, do not stay in your car and try to outrun a tornado. If possible, stop the car and enter the nearest business and seek shelter.
- If you are outside and it is not possible to get inside, seek a low-lying ditch, culvert, etc. and keep your body as low to the ground and as braced as possible. **Flooding**

Flooding may occur at or en-route to and from the Site and may be the result of weather conditions or due to thawing of ice and snow (especially in the Spring).

In the event flooding occurs:

- Stay tuned to NOAA Weather Radio All Hazards, your local radio and TV stations (i.e., The Weather Channel) for updates, watches, warnings or emergency instructions.
- Know the Coastal Evacuation Route for coastal area or an inland area with chronic flooding
- If the waters start to rise inside before you have evacuated, retreat to higher ground, including the roof. Use cell phone or landline to call for help. Take a flashlight and a portable radio. Then, wait for help. Do not try to swim to safety; wait for rescuers to come to you.
- Avoid flooded areas. Do not attempt to cross any flooded areas in a vehicle or on foot. Floodwaters may be deeper than they look.
- Avoid low-lying areas like ditches, creeks, and rivers.
- Before entering or re-entering a building, check for any signs of structural damage.
- When entering a building, do not use matches, lighters, or open flame. Use a flashlight only.
- After a flood, steps and floors are often slippery with mud and covered with debris, including nails and broken glass. Be careful walking around.

3.4.7 Snow/Freezing Rain

If a winter storm “watch” is issued for your area, it means that conditions are right for severe weather. If a winter storm “warning” is issued, it means that severe weather exists and may be moving into your area. Stay tuned to local weather information for updates on changing conditions. If a winter storm “warning” is issued for your area, stay indoors and travel only if it is absolutely necessary.

If a snow or ice storm occurs while at work, BC personnel should stay or leave at his or her own discretion. If you must travel during serious winter weather, do the following:

- Keep your gas tank full.
- Be sure your car is winterized with the proper anti-freeze.
- Keep survival supplies in your trunk.
- Let someone know your destination and the exact route you will be taking, in case you become stranded.

If you become stranded, stay with your car. Start your car and let it run with the heater on for approximately 10 minutes per hour. Be sure the exhaust pipe is clear of snow. When your car is running, leave the dome light on so that it is easier for someone to see you. Keep a window open a crack that is not exposed to strong winds. Move your arms and legs frequently to help keep blood circulating.

Avoid downed power lines. If power lines contact your car, stay inside until professional rescuers arrive. Most cars are insulated, providing protection from electricity as long as you avoid contact with metal parts of the car. Similarly, avoid rescuing anyone from a car that has encountered downed power lines.

When conducting Site activities in snow/freezing rain conditions, exposure to the elements should be limited. This is particularly important for the extremities such as hands/fingers, feet/toes, and the face/nose. See Section 3.3.3 for information about Cold Stress signs, symptoms and treatment.

3.5 Biological Hazards

The following biological hazards have been identified and may be encountered during scheduled field activities:

- | | | |
|--|--|---|
| ☐ Bloodborne Pathogens/Sanitary Waste | ☒ Rodents | ☒ Other Mammals/Predators |
| ☒ Venomous Insects | ☒ Mosquitoes | ☒ Poisonous Plants |
| ☐ Fire Ants (Venomous Insects) | ☒ Ticks | ☐ Phragmites |
| ☒ Spiders/Scorpions | ☐ Pets/Farm Animals | ☐ Snakes |
| ☐ Alligators | ☐ Chiggers | ☐ Other: |

If any biological hazards are identified at the site, workers in the area will immediately notify the SSO and nearby personnel.

3.5.1 Rodents

Animals may potentially carry the rabies virus or disease-causing agents. Do not attempt to feed or touch animals. Feces from some small mammals may contain diseases such as Hantavirus. Avoid generating dust near rodent feces.

3.5.2 Venomous Insects

Common examples include bees, fire ants and wasps. Avoid contact with insects and their hives. If stung, remove the stinger by gently scraping it out of the skin (do not use tweezers). If the worker is stung by an insect, immediately apply an ice pack to the affected area and wash area with soap and water and apply antiseptic. If an allergic reaction occurs, contact emergency medical services for appropriate treatment. Seek medical attention immediately if you are allergic to venomous stings such as bees or if anaphylaxis symptoms are present.

3.5.3 Mosquitoes

Mosquitoes may transmit diseases such as West Nile Virus. Symptoms of West Nile Virus include: fever, headache, tiredness, body aches, and occasional rash. Avoid mosquito bites by wearing a long-sleeved shirt and long pants. Apply insect repellent to clothes and/or skin (if FDA approved for topical use). Report any dead birds in the area to local health officials. Mosquitoes are most active from dusk to dawn.

3.5.4 Spiders/Scorpions

The black widow and brown recluse spiders are the most venomous. Avoid contact with spiders and scorpions and areas where they may hide. They favor dark hiding places. Inspect clothing and shoes before getting dressed. Wear gloves and safety shoes when working with lumber, rocks, inspecting buildings, etc. Signs and symptoms of bites include: headache, cramping pain/muscle rigidity, rash and/or itching, nausea, dizziness, vomiting, weakness or paralysis, and convulsions or shock. Wash bite area with soap and water and apply antibiotic cream. Contact emergency medical services if allergic reaction or severe symptoms occur.

3.5.5 Ticks

Ticks are known to carry disease-causing microbes and the potential for transmission of these microbes and related diseases increases the longer a tick has been embedded following a bite. These diseases include, but are not limited to, Lyme disease and Rocky Mountain Spotted fever as the most common. Ticks are found throughout the United States and come in varying sizes from small, medium to large depending on their stage in life; however, deer ticks are known to be small around the size of a pin-point. Habitats range from tall grassy to woodland areas. Whenever possible, avoid areas likely to be infested with ticks during the spring and summer months.

When a potential tick habitat is identified, the following controls should be implemented:

- Ask the question of your PM if the potential tick habitat area needs to be accessed, prior to proceeding, making the attempt to remove the identified hazard (potential of tick exposure).
- If you are unable to remove the hazard, see if there are other options to reduce the exposure potential such as asking the PM or client whether the area can be cleared or mowed prior to entering.
- Even with a reduced exposure potential, exposure control precautions must be taken prior to entering the area. These include, but are not limited to:
 - Wear light-colored clothing so ticks will be visible on the surface.
 - Wear a long-sleeve shirt and Not only tuck pants into socks/boots but also tuck your shirt into your pants.
 - Persons with long hair should tie their hair back to minimize the potential for ticks to nestle in the scalp.
 - Use an FDA-approved insect repellent that contains DEET or other insect repellents that are known to contain chemicals/products (picaridin, Oil of Lemon Eucalyptus, para-methanesiol, etc.) to address ticks specifically.
 - In areas known to have high-tick populations don clothing that is pre-treated with tick repellent such as Permethrin. If pre-treated clothing is not available, don Tyvek suits prior to entering the area and immediately removing them following exposure. Please note that using Tyvek suits may increase the risk of heat stress conditions so extra precautions should be taken, such as more frequent breaks and drinking plenty of fluids

Following exposure:

- Separate clothing and PPE that has been exposed to ticks for disposal or cleaning.
- Conduct a thorough check immediately following exposure.
- Shower as soon possible after being outdoors. Consider having a second person perform a tick check on you; it is difficult to see what is behind you.

If a tick is embedded in the skin, use pointy tweezers to grasp the tick's head (near the skin) and pull straight out. Consider saving the removed tick for potential future laboratory analysis. Once the tick-bite area has been treated using standard first-aid measures, notify your SM of the incident. Incident Intervention may be offered as an added first-aid measure to assist employee in monitoring for signs/symptoms of tick-borne diseases.

Signs of Lyme disease include a reddish "bull's-eye" around the affected area approximately a week after the bite. Symptoms include headache, fever, and muscle/joint pain. Persons suspecting infection should immediately notify their SM or the BC Injury Risk Manager.

3.5.6 Poisonous Plants

Common examples include poison ivy, poison oak and poison sumac. Avoid contact. Long-sleeved shirts and pants will allow some protection against inadvertent contact. If contact occurs, immediately wash the affected area thoroughly with soap and water. If an allergic reaction occurs, seek the care of a medical professional.

Poison Ivy grows in many forms including groundcover, shrub or is a trailing or climbing woody vine with leaves that are each divided into three broad, pointed leaflets found throughout the United States (US) with the exception of California, Alaska and Hawaii. The leaflets are commonly dark glossy green on top and slightly hairy underneath. They produce small yellowish or greenish flowers followed by berry-like drupes.



Poison Oak is a member of the same family as poison ivy and has a very similar appearance; however, not as widespread. There are 2 species found in the US: Eastern Poison Oak and Western Poison Oak. Both species of poison oak has leaves divided into three leaflets and generally has three to seven distinct lobes. Typically, they are a shrubby type plant that can grow to eight feet in height, or sometimes can be a climbing plant. Colors range and from bronze, bright green, yellow-green or red as the seasons change and may also contain greenish-white or tan berries.



Poison Sumac is a deciduous woody shrub or small tree found in the eastern United States in swamp or other wet area, pine woods, and shady hardwood forest habitats. Poison sumac grows up to 20 feet with leaves consist of 7 – 13 leaflets (always an odd number). Distinctive features include reddish stems and petioles. Leaflets are elongated, oval, and have smooth margins. Poison sumac also produces clusters of small berries that are white or grey.



The best way to prevent exposure is the ability to recognize these plants. Conduct an initial survey of the area to determine if the plants are present in the work area and avoid contact with them.

If plants are located and work must be conducted in that area, speak with your PM or Client about having the plants removed if possible. If this is not possible, wear long sleeved shirts, gloves, and a heavy material type pants. Remember not to touch contaminated clothing. There are products available that can be applied to exposed skin, similar to sunscreen products, prior to working around the plants. Tyvek suits may be another option used at the wearer's discretion to keep poisonous plant oils from getting on clothing. Please note that using Tyvek suits may increase the risk of heat stress conditions so extra precautions should be taken, such as more frequent breaks and drinking plenty of fluids

3.5.7 Other Mammals/Predatory Animals

Animals such as stray dogs, bears, or wild predators (i.e., cougars or coyotes) may pose an attack hazard.

Do not attempt to enter or work in an area if you observe an aggressive animal or predator in that area. If you are working and an aggressive animal or predator moves into your area, then slowly back away in a non-threatening manner. In order to avoid such encounters, use the buddy system and make noise when working in areas where such animals may be present.



Section 4

Personal Protective Equipment

A hierarchical approach that employs engineering and administrative controls including Personal Protective Equipment (PPE) will be utilized to mitigate hazards likely to be encountered during the performance of the project scope of work. Because of this hazard management approach, PPE will be required for site personnel. The amount and type of PPE used will be based on the nature of the hazard encountered or anticipated.

Dermal protection, primarily in the form of chemical-resistant gloves and coveralls, will be worn whenever contact with chemically affected materials (e.g., soil, groundwater or sludge) is anticipated. Respiratory protection will be utilized when an airborne hazard has been identified using real-time air monitoring devices, or as a precautionary measure in areas designated by the SM or SSO.

Based on the hazards identified for this project, the following levels of PPE will be required and used. Changes to the specified levels of PPE will not be made without the approval of the SSO after consultation with the SM.

4.1 Level D Protection

In general, site activities will commence in Level D PPE unless otherwise specified, or if the SSO determines on-site that a higher level of PPE is required. Air monitoring of employee breathing zones will be routinely conducted using real-time air monitoring devices to determine if upgrading to Level C PPE is necessary. Level D PPE will be permitted as long as air monitoring data indicates that airborne concentrations of chemicals of concern are maintained below the site-specific action levels defined in Section 5. Level A or B PPE is not anticipated and is therefore not addressed in this plan. If Level A or B PPE is necessary, this HASP will be revised to reflect changes as appropriate.

The following is the minimum PPE required to conduct activities at the site:

- Work shirt and long pants,
- ASTM- approved steel/safety-toed boots,
- ANSI-approved safety glasses,
- ANSI-approved (Class 2 or 3) High-visibility traffic safety vest or outerwear, and

The following additional task-specific PPE should be donned as appropriate:

- ANSI-approved hard hat if/when overhead hazards are present and/or when working in close proximity to heavy equipmentHearing protection with a Noise Reduction Rating (NRR) of 28 or above when working around operating equipment, or other environment where excessive noise exposure is a potential.
- Sturdy work gloves (e.g., leather, Kevlar, others as appropriate) when hand abrasion, cuts or puncture is a potential.
- Outer nitrile gloves (11 mil or thicker) and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for

collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event).

- Chemical-resistant clothing (e.g., Tyvek or poly-coated Tyvek coveralls) when working in overgrown areas where there is an increased exposure potential to ticks and/or chiggers.

4.2 Level C Protection

As previously stated, respiratory protection may be required when an airborne hazard has been identified using real-time air monitoring devices. If air monitoring indicates that the site-specific action levels defined in Section 5 are exceeded, workers in the affected area(s) will upgrade PPE to Level C. In addition to the PPE specified for Level D, Level C also includes the following:

- NIOSH-approved half- or full-face air-purifying respirator (APR) equipped with appropriate cartridges (reference Section 5). Note: Safety glasses are not required when wearing a full-face APR.

Respirator Cartridge Replacement	
Type of Cartridge	Cartridge Change-out Schedule
Particulate (e.g., HEPA)	At least weekly or sooner, the employee detects an increase in breathing resistance. This will occur as the filter becomes loaded with particulate matter.
Sorbent (e.g., organic vapor)	At the end of each day's use or sooner if the employee detects an abnormal odor or other indicator.

Respirator Use Guidelines:

- Personnel who wear air-purifying respirators must be trained in their use and must have successfully passed either a qualitative or quantitative respirator fit test and medical evaluation within the last 12 months in accordance with 29 CFR 1910.134.
- Respirators must be certified or approved by the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services certified respirators. A label or statement of certification should appear on the respirator or respirator packaging. The label will describe the intended use of the respirator along with providing a respiratory protection factor used, in part, to determine the Air Monitoring Action Limits specified in Section 5.3.
- Respirators will be stored in clean containers (e.g., self-sealing bag) when not in use.
- Personnel should familiarize themselves with instructions provided by the manufacturer on respirator use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
- Respiratory protection should only be worn in atmospheres appropriate for the specific respirator and cartridge.

NOTE: Dust Masks (e.g., filtering face-piece respirators) may be used in nuisance dust situations where respirator use is not otherwise required (i.e., voluntary use).

4.3 Stop Work Conditions

If air monitoring indicates that the site-specific action levels defined in Section 5.3 are exceeded, activities will cease, and personnel must evacuate the designated Exclusion Zone. The PM and SM will be contacted immediately.

Work will also cease if unanticipated conditions or materials are encountered or if an imminent danger is identified. The SSO will immediately contact the SM for consultation.



Section 5

Air Monitoring Plan

Real-time air monitoring devices will be used to analyze airborne contaminant concentrations approximately every 15 minutes in the workers' breathing zones while workers are in the designated Exclusion Zone, or when task or exposure conditions change (whichever frequency is less). If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate.

Background concentrations will be determined at the beginning of each work shift by collecting several instrument readings upwind of the scheduled activities. Alternatively, background levels can be determined by collecting readings from a nearby (upwind) area that can reasonably be considered unaffected by Site activities.

Real-time measurements will be made as near as feasible to the breathing zone of the worker with the greatest exposure potential in each active work area. If authorized by the SM, real time measurements may cease being taken when sufficient historical data is generated to warrant its cessation. Air monitoring will be reinstated if potential exposure conditions change.

The equipment will be calibrated daily, and the results will be recorded on BC's Air Monitoring Form. The results of air monitoring will also be recorded on the Air Monitoring Form and will be retained in the project files following completion of field activities. A copy of the Air Monitoring Form is located in Appendix A.

5.1 Monitoring Instruments

Air monitoring will be conducted as outlined in this Section during the following activities:

- Well vault/cap opening,
- Water level gauging,
- Monitoring well purge/sampling activities

5.1.1 Photoionization Detector and Flame Ionization Detector

A calibrated photoionization detector (PID) with a lamp strength of 10.6 eV or flame ionization detector (FID) will be used to monitor changes in personnel exposure to volatile organic compounds (VOCs). The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of VOCs in employee breathing zones. If VOCs are detected above predetermined action levels specified in Section 5.2, the procedures found in Section 4 of this HASP will be followed.

5.1.1.1 Opening Wells and Well Vaults

When VOCs are identified as part of a Site's potential chemicals of concern, direct-reading instrumentation will be used to monitor any work in or immediately around a well or well vault. The well vault (outer protective casing/cover and/or well plug) will be opened carefully with personnel staying upwind as much as possible and then left open for a minimum of three (3) minutes to allow the well to vent. Please note that if there are other established protocols that differ from 3 minutes; the more protective time increment will be followed. Personnel should stay upwind as much as possible while

working in and around the vault. Additional information regarding direct-reading instrumentation, associated action levels and documentation requirements is outlined within the projects Air Monitoring Plan included as Section 5 of this plan.

5.2 Site-Specific Action Levels

The following action levels were developed for exposure monitoring with real-time air monitoring instruments. Air monitoring data will determine the required respiratory protection levels at the site during scheduled intrusive activities. The action levels are based on sustained readings indicated by the instrument(s). Air monitoring will be performed and recorded at up to 15-minute intervals.

If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. If during this time, sustained measurements are observed, the following actions will be instituted, and the PM and SM will be notified. For purposes of this HASP, sustained readings are defined as the average airborne concentration maintained for a period of 1 minute above established background levels.

5.2.1 Action Levels for Volatile Organic Compounds

VOC – Action Levels		
Activity	Action Level	Level of Respiratory Protection
Groundwater monitoring/NAPL gauging	< 5 ppm above background	Level D: No respiratory protection required.
	5 to 25 ppm (VOCs)	Increase engineering control efforts and re-monitor effectiveness. If unable to maintain levels below 5 ppm, then upgrade respiratory protection. Level C: Half- or full-face air-purifying respirator fitted with organic vapor cartridges/ Contact SM prior to respirator upgrade.
	> 25 ppm (VOCs)	Cease operations and evacuate work area. Contact SM and PM immediately.

Section 6

Site Control Measures

The SSO will conduct a safety inspection of the work site before each day's activities begin to verify compliance with the requirements of the HASP. Results of the first day's inspection will be documented on the Site Safety Checklist. A copy of the checklist is included in Appendix B. Thereafter, the SSO should document unsafe conditions or acts, along with corrective action, in the project notes or field logbook.

Procedures must be followed to maintain site control so that persons who may be unaware of site conditions are not exposed to hazards. The work area will be barricaded by tape, warning signs, or other appropriate means. Site equipment or machinery will be secured and stored safely.

Access to the specified work area will be limited to authorized personnel. Only field personnel and subcontractors meeting the training requirements as defined within this HASP will be admitted to the work site. Visitors may be escorted into the work area if they have received the orientation training as defined within this HASP, donned appropriate PPE and all activities within the area have ceased. All personnel entering the work area, including visitors, are required to sign the H&S Plan Review Acknowledgement Form of this HASP, indicating they have read and accepted the H&S practices outlined in this plan.

In some instances, it may be necessary to define established work zones: an Exclusion Zone, a Contamination Reduction Zone and a Support Zone. Work zones may be established based on the extent of anticipated contamination, projected work activities, and the presence or absence of non-project personnel. The physical dimensions and applicability of work zones will be determined for each area based on the nature of job activity and hazards present. Within these zones, prescribed operations will commence using appropriate PPE. Movement between zones will be controlled at checkpoints.

Considerable judgment is needed to maintain a safe working area for each zone, balanced against practical work considerations. Physical and topographical barriers may constrain ideal locations. Field measurements combined with climatic conditions may, in part, determine the control zone distances. Even when work is performed in an area that does not require the use of chemical-resistant clothing, work zone procedures may still be necessary to limit the movement of personnel and retain adequate site control.

Personnel entering the designated Exclusion Zone should exit at the same location. There must be an alternate exit established for emergency situations. In all instances, worker safety will take precedence over decontamination procedures. If decontamination of personnel is necessary, exiting the site will include the decontamination procedures described in the following section.

Section 7

Decontamination Procedures

Despite protective procedures, personnel may come in contact with potentially hazardous compounds while performing work tasks. Decontamination will take place in the decontamination area identified on-site and needs utilize an Alconox®, Liqui-Nox® or Trisodium Phosphate (TSP) wash followed by a rinse with clean water.

Workers, PPE, sampling equipment and heavy equipment leaving the exclusion area will be inspected to determine the level of decontamination necessary to prevent the spread of potentially hazardous materials. Unnecessary equipment and support vehicles are to be left outside the designated Exclusion Zone so that decontamination will not be necessary.

Standard decontamination procedures for Levels C and D are as follows:

- equipment drop,
- boot cover and outer glove wash and rinse,
- boot cover and outer glove removal,
- suit removal,
- safety boot wash and rinse,
- inner glove wash and rinse,
- respirator removal,
- inner glove removal, and
- field wash of hands and face.

Site workers should employ only applicable steps in accordance with level of PPE worn and extent of contamination present. The SSO shall maintain adequate quantities of clean water to be used for personal decontamination (i.e., field wash of hands and face) whenever a suitable washing facility is not located in the immediate vicinity of the work area.

Disposable items will be disposed of in an appropriate container. Wash and rinse water generated from decontamination activities will be handled and disposed of properly. Non-disposable items (e.g., respirators) may need to be cleaned or sanitized before reuse. Each site worker is responsible for the maintenance, decontamination and sanitizing of their own PPE.

Used equipment may be decontaminated as follows:

- Remove adhered materials (e.g., dirt or mud) to increase the effectiveness of the decontamination process.
- An Alconox®, Liqui-Nox® or TSP and water solution may be used to wash the equipment.
- The equipment will then be rinsed with clean water until it is determined clean.

Each person must follow these procedures to reduce the potential for transferring chemically affected materials off-site.

Section 8

Training Requirements

Field Personnel, including subcontractors, conducting work in controlled areas of the site, must have completed the appropriate training as required by 29 CFR 1910.120. In addition, the designated SSO(s) will have completed the 8-hour Site Supervisor course, have current training in first aid and CPR along with any additional training appropriate to the level of site hazards.

Field personnel, subcontractors and visitors will receive a site orientation training that will include, but not necessarily be limited to, emergency procedures, site control, personnel responsibilities and the provisions of this HASP. Field Personnel, subcontractors and visitors will document that they have been briefed on the hazards identified at the site and that they have read and understand the requirements of this HASP by signing the HASP Acknowledgement Form attached as Appendix C.

A daily morning briefing, to cover safety procedures and contingency plans in the event of an emergency, is to be included with a discussion of the day's activities. It is expected that field personnel, subcontractors and visitors will participate in these meetings that will be recorded on the Daily Tailgate Safety Meeting Form. A copy of the Daily Tailgate Safety Meeting Form is included in Appendix D.



Section 9

Medical Surveillance Requirements

Field personnel, including subcontractors, who will or may work in an area designated as an exclusion zone must have fulfilled the appropriate medical monitoring requirements in accordance with 29 CFR 1910.120(f). Field Personnel, including subcontractors, entering an exclusion zone must have successfully completed an annual surveillance examination and/or an initial baseline examination within the last 12 months.

Medical surveillance is conducted as a routine program for BC field staff in accordance with the requirements of 29 CFR 1910.120(f). There will not be any special medical tests or examinations required for BC staff involved in this project.

A Hepatitis B vaccination will be offered to BC personnel before the person participates in a task where direct exposure to potentially infectious materials is a possibility (e.g., first aid or CPR). For personnel who have potential exposure to sanitary wastes, a current tetanus/diphtheria inoculation or booster is recommended.

Section 10

Contingency Procedures

Minimum emergency equipment maintained on-site will include a fully charged ABC dry chemical fire extinguisher, an adequately stocked first aid kit, and an emergency eyewash station (when corrosive chemicals are present). In addition, employees will consider maintaining the personal emergency supply items listed in Section 3.4: Natural Phenomena, as appropriate.

In the event of an emergency, site personnel will signal distress with three blasts of a horn (a vehicle horn will be sufficient), or another predetermined signal. Communication signals, such as hand signals, must be established where communication equipment is not feasible or in areas of loud noise.

It is the SSO's duty to evaluate the seriousness of the situation and to notify appropriate authorities. The first part of this plan contains emergency telephone numbers as well as directions to the hospital. Nearby telephone access must be identified and available to communicate with local authorities. If a nearby telephone is not available, a cellular telephone will be maintained on-site during work activities. The operation of the cellular phone will be verified to confirm that a signal can be achieved at the work location.

The SSO, or designee, should contact local emergency services in the event of an emergency. After emergency services are notified, the PM and SM will be notified of the situation as soon as possible. If personal injury, property damage or equipment damage occurs, the PM and BC Risk Manager will be contacted as soon as practicable. An Incident Investigation Report will be completed within 24 hours by the SSO, or another designated person. A copy of the Incident Investigation Report is included in Appendix E.

10.1 Injury or Illness

If an exposure or injury occurs, work will be temporarily halted until an assessment can be made to determine it is safe to continue work. The SSO, in consultation with the SM, will make the decision regarding the safety of continuing work. The SSO will conduct an investigation to determine the cause of the incident and steps to be taken to prevent recurrence.

In the event of an injury, the extent and nature of the victim's injuries will be assessed, and first aid/CPR will be rendered as appropriate. If necessary, emergency services will be contacted, or the individual may be transported to the nearby medical center. The mode of transportation and the eventual destination will be based on the nature and extent of the injury. A hospital route map is presented at the front of this HASP.

In the event of a life-threatening emergency, the injured person will be given immediate first aid and emergency medical services will be contacted by dialing the number listed in the Critical Project Information section at the beginning of this plan. The individual rendering first aid will follow directions given by emergency medical personnel via telephone.

10.2 Vehicle Collision or Property Damage

If a vehicle collision or property damage event occurs, the SSO, or designee, will contact the BC Risk Manager for appropriate action.

10.3 Fire

In the event of fire, the alarm will be sounded, and site personnel will evacuate to a safe location (preferably upwind). The SSO, or designee, should contact the local fire department immediately by dialing 911. When the fire department arrives, the SSO, or designated representative, will advise the commanding officer of the location and nature of the fire, and identification of hazardous materials on-site. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. Site personnel should not attempt to fight a fire if it poses a risk to their personal safety.

Note that smoking is not permitted in controlled areas (e.g., exclusion or contamination reduction zones), near flammable or combustible materials, or in areas designated by the facility as non-smoking areas.

10.4 Underground Utilities

In the event that an underground conduit is damaged during subsurface work, mechanized equipment will immediately be shut off and personnel will evacuate the area until the nature of the piping can be determined. Depending on the nature of the broken conduit (e.g., natural gas, water, or electricity), the appropriate local utility will be contacted.

10.5 Site Evacuation

The SSO will designate evacuation routes and refuge areas to be used in the event of a site emergency. Site personnel will stay upwind from vapors or smoke and upgradient from spills. If workers are in an Exclusion or Contamination Reduction Zone at the start of an emergency, they should exit through the established decontamination corridors, if possible. If evacuation cannot be done through an established decontamination area, site personnel will go to the nearest safe location and remove chemically-affected clothing there or, if possible, leave it near the Exclusion Zone. Personnel will assemble at the predetermined refuge following evacuation and decontamination. The SSO, or designated representative, will count and identify site personnel to verify that all have been evacuated safely.

10.6 Spill of Hazardous Materials

If a hazardous material spill occurs, site personnel should locate the source of the spill and determine the hazard to the H&S of site workers and the public. Attempts to stop or reduce the flow should only be performed if it can be done without risk to personnel.

Isolate the spill area and do not allow entry by unauthorized personnel. De-energize sources of ignition within 100 feet of the spill, including vehicle engines. Should a spill be of the nature or extent that it cannot be safely contained or poses an imminent threat to human health or the environment, an emergency cleanup contractor will be called out as soon as possible. Spill containment measures listed below are examples of responses to spills.

- Right or rotate containers to stop the flow of liquids. This step may be accomplished as soon as the spill or leak occurs, providing it is safe to do so.



- Sorbent pads, booms, or adjacent soil may be used to dike or berm materials, subject to flow, and to solidify liquids.
- Sorbent pads, soil, or booms, if used, must be placed in appropriate containers after use, pending disposal.
- Contaminated tools and equipment shall be collected for subsequent cleaning or disposal.



Section 11

Documentation

The implementation of the HASP must be documented on the appropriate forms (see appendices) to verify employee participation and protection. In addition, the regulatory requirements must be met for recordkeeping on training, medical surveillance, injuries and illnesses, exposure monitoring, health risk information and respirator fit-tests. Documentation of each BC employee's H&S records is maintained electronically by the H&S Data Manager.

H&S documentation and forms completed, as specified by this plan, are to be retained in the project file.

Other relevant project-specific H&S documents, such as SDSs or client-specified procedures, will be attached to this HASP in Appendix F.

Appendix A: Air Monitoring Form





AIR MONITORING FORM

Page ____ of ____

Air Monitoring Documentation/Log

Project Name:	Project Number:
Site Location:	
Employee/Company Performing Air Monitoring (Name/Signature):	Date:

Instrument(s)

Manufacturer/Model:	Manufacturer/Model:
---------------------	---------------------

Does the instrument(s) have a current calibration per the manufacturer's instructions? ☐ Yes ☐ No

Was the instrument(s) field checked (i.e. bump tested or field calibrated) per the manufacturer's instructions? ☐ Yes ☐ No

Remarks:

Monitoring Data

Time	Location and Activity	P/FID (ppm)	Colorimetric Tubes (PPM)	RAM (mg/m ³)	Multi-Gas Detection			
					%LEL	H ₂ S	O ₂	Other



Page ____ of ____

[illegible]

Appendix B: Site Safety Checklist



Appendix C: Acknowledgement Form





ACKNOWLEDGMENT FORM

Page ____ of ____

H&S Plan Review and Site Orientation Acknowledgement

Project Name:	Project Number:
Site Location:	
Employee/Company Performing Review (Name/Signature):	Date of Review:

BC Employee Acknowledgement:

The following signatures indicate that these personnel have read and/or been briefed on this Safety Plan and understand the potential hazards/controls for the work to be performed.

Print	Sign	Date	Print	Sign	Date

Subcontractor Acknowledgment:

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors should operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own Safety Plan for this project or other health and safety program documents for review.

BC's Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's Safety Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor will remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's Safety Plan to identify all hazards that may be present at the site. Subcontractor personnel are expected to comply fully with subcontractor's H&S Plan and to observe the minimum safety guidelines applicable to their activities, which may be identified in the BC Safety Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Print	Sign	Date	Print	Sign	Date



Appendix D: Tailgate Meeting Form





Tailgate Meeting Participation Acknowledgement

Project Name:	Project Number:
Site Location:	
Employee/Company Performing Briefing (Name/Signature):	Date of Briefing:

PAUSE - Plan of the Day

(Describe the activities that are planned to be performed today. Discuss what is the worst that could happen?)

THINK - Potential Hazards and Controls

(Describe the potential hazards and controls that may be associated with planned activities. Are all necessary precautions in place?)

Hazard Type	Site-Specific Hazard Discussion	Discussed Controls
☐ Physical		
☐ Natural		
☐ Chemical		
☐ Biological		
☐ Electrical		
☐ Other (specify):		

GO - Only when work can be performed safely!

Important Notice to Subcontractor(s):

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own H&S Plan for this project or other health and safety program documents for review.

This FWSP has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of the FWSP may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, FWSP does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on FWSP to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the FWSP. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.



Page ____ of ____

The following signatures indicate that these personnel (BC and Subcontractors) have read and/or been briefed on this Safety Plan and understand the potential hazards/controls for the work to be performed and have reviewed these hazards and/or task-specific hazards prior to commencing activities on a daily basis.

[illegible]

Appendix E: Preliminary Incident Investigation Form





PRELIMINARY INVESTIGATION FORM

Page ____ of ____

Privileged and Confidential – Attorney Work Product

Instructions: The form has been developed to support the incident investigation and reporting process and should be maintained under Privileged and Confidential protocols and never distributed outside of Brown and Caldwell. If shared via email internally, transmittal should be directed to BC Legal Counsel with other employees copied as applicable. Note that this form is for preliminary investigation purposes and a final report should be completed within the BC Electronic System within a reasonable time following the incident and preliminary assessment and corrective action activities.

General Information	
Date/Time of Incident Occurred:	Project/Work Area Incident Occurred:
Incident Classification: ☐ Close Call/Near Miss ☐ Injury/Illness ☐ Property Damage ☐ Environmental ☐ Vehicle ☐ Security ☐ Fire/Explosion ☐ Chemical/Hazardous Atmosphere Exposure ☐ Other:	
Incident/Close Call Immediate Response: ☐ First Aid Provided ☐ Incident Intervention Initiated ☐ Facility Emergency Services Notified ☐ Site Evacuated ☐ Off-site Local Emergency Services Notified – Service: ☐ Off-site Transport for Medical Attention - Method of Transport: ☐ Other:	
Facility/Site Regulated Under Either of the Following: ☐ Mining Safety and Health Administration (MSHA) ☐ Federal Railroad Administration (FRA)	
Personnel Involved (Company/Name):	
Witnesses (Company/Name):	
Notifications	
Date/Time Incident/Close Call Reported:	Incident/Close Call Reported to Whom:
Date/Time Incident/Close Call Reported to BC:	Incident/Close Call Reported to Whom at BC:
Date/Time Client Notified of Incident/Close Call	Method Client Notified: ☐ Phone Call ☐ Email ☐ Other:
Field Investigation	
Field Investigation Lead (Company/Name)	Date/Time Incident Investigated:



PRELIMINARY INVESTIGATION FORM

Page ____ of ____

Privileged and Confidential – Attorney Work Product

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General Information	
Date/Time of Incident Occurred:	Project/Work Area Incident Occurred:
Task/Activities Performed at time of Incident:	
Brief Description of Incident:	

Field Investigation (Continued)	
Witness(s) Statement (use additional sheets as applicable):	
Technical Expert(s) Consulted: ☐ Yes ☐ No	Technical Expert(s) (Company/Name):
Technical Expert(s) Statement (use additional sheets as applicable):	

Root-Cause Analysis



PRELIMINARY INVESTIGATION FORM

Page ____ of ____

Privileged and Confidential – Attorney Work Product

Instructions: The form has been developed to support the incident investigation and reporting process and should be maintained under Privileged and Confidential protocols and never distributed outside of Brown and Caldwell. If shared via email internally, transmittal should be directed to BC Legal Counsel with other employees copied as applicable. Note that this form is for preliminary investigation purposes and a final report should be completed within the BC Electronic System within a reasonable time following the incident and preliminary assessment and corrective action activities.

Field Investigation (Continued)

Substandard Actions:

What substandard actions caused or could have caused the accident/incident?

- | | | |
|--|--|---|
| ☐ Failure to recognize hazard(s) | ☐ Improper lifting | ☐ Servicing equipment in operation |
| ☐ Failure to use equipment or use it properly | ☐ Improper loading, placement, or position for task | ☐ Using defective equipment |
| ☐ Failure to use PPE or use it properly | ☐ Performing excessive repetitive activities | ☐ Unclassified (not determined) |
| ☐ Failure to warn, secure, or barricade | ☐ Operating equipment without authority | ☐ Other: |
| ☐ Horseplay | ☐ Removing or making safety devices inoperable | |

State the actions on the part of the employee or others that contributed to the occurrence of the accident/incident.

Substandard Conditions:

What substandard conditions caused or could have caused the accident/incident?

- | | | |
|---|---|--|
| ☐ Congested or restricted area | ☐ Inadequate guards or barriers | ☐ Poor housekeeping |
| ☐ Defective tools, equipment, or materials | ☐ Inadequate or excessive illumination | ☐ Radiation exposures |
| ☐ Fire or explosion hazards | ☐ Inadequate ventilation | ☐ Unclassified (not determined) |
| ☐ Hazardous environmental conditions (vapors, dusts, etc.) | ☐ Inadequate walking/working surfaces | ☐ Other: |
| ☐ High or low temperature exposures | ☐ Noise Exposures | |

State the conditions that existed at the time of the accident (the specific control factors that were or may have been the direct or immediate cause or causes of the accident):



PRELIMINARY INVESTIGATION FORM

Page ____ of ____

Privileged and Confidential – Attorney Work Product

Instructions: The form has been developed to support the incident investigation and reporting process and should be maintained under Privileged and Confidential protocols and never distributed outside of Brown and Caldwell. If shared via email internally, transmittal should be directed to BC Legal Counsel with other employees copied as applicable. Note that this form is for preliminary investigation purposes and a final report should be completed within the BC Electronic System within a reasonable time following the incident and preliminary assessment and corrective action activities.

Root-Cause Analysis (Continued)

Personal and Job Factors:

What personal and/or job factors caused or could have caused the accident/incident?

Personal Factors:

- | | | |
|---|---|--|
| ☐ Alcohol or drug influence (possible) | ☐ Inattention | ☐ Unclassified (not determined) |
| ☐ Fatigue | ☐ Rushing to complete work | ☐ Other: |
| ☐ Inadequate skill, capability, knowledge, or training | | |

Job Factors:

- | | | |
|---|--|--|
| ☐ Inadequate engineering | ☐ Inadequate planning or accelerated schedule | ☐ Unclassified (not determined) |
| ☐ Inadequate leadership/supervision | ☐ Inadequate tools/equipment | ☐ Other: |
| ☐ Inadequate maintenance, wear, abuse, or misuse | ☐ Inadequate work standards/procedures | |

State the influencing factors or underlying causes, either conditions or actions or both, that contributed to the accident/incident.

Remedial/Corrective Actions

- | | | |
|--|---|--|
| ☐ Equipment repair or replacement | ☐ Install safety guard or device | ☐ Use safer materials or equipment |
| ☐ Improve design or construction | ☐ Reinstruction or reprimand of personnel involved | ☐ Develop and publish lessons learned |
| ☐ Improve housekeeping | ☐ Temporary/permanent reassignment of personnel | ☐ Employee Re-training |
| ☐ Improve PPE | ☐ Work method change | ☐ Unclassified (not determined) |
| ☐ Removal of Employee from site | ☐ Removal of Company from site | ☐ Other: |

Briefly describe the actions taken or planned to prevent recurrence of accident/incident - provide the implementation date and person responsible for any planned corrective action.



PRELIMINARY INVESTIGATION FORM

Page ____ of ____

Privileged and Confidential – Attorney Work Product

Instructions: The form has been developed to support the incident investigation and reporting process and should be maintained under Privileged and Confidential protocols and never distributed outside of Brown and Caldwell. If shared via email internally, transmittal should be directed to BC Legal Counsel with other employees copied as applicable. Note that this form is for preliminary investigation purposes and a final report should be completed within the BC Electronic System within a reasonable time following the incident and preliminary assessment and corrective action activities.

Root-Cause Analysis (Continued)

Responsible Party (Company/Name):

Assigned Deadline for Implementation (Date/Time):

Appendix F: Miscellaneous H&S Information



GENERIC
ENVIRONMENTAL HEALTH AND SAFETY PLAN
FOR
SITE INVESTIGATIONS
AT NON-OWNED FORMER MGP SITES

NOVEMBER 2002

Prepared for:

Niagara Mohawk, A National Grid Company
300 Erie Boulevard West
Syracuse, New York

Reviewed and Approved by: _____
(Signature) (Date)

Site Specific

Revisions Attached: Supplement No. _____ Date _____

GENERIC ENVIRONMENTAL HEALTH AND SAFETY PLAN

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APPROVALS

By their signatures, the undersigned certify that this Generic Environmental Health and Safety (EHS) Plan is approved and will be utilized at all Niagara Mohawk Non-owned Former MGP Sites.

Engineering Consultant Program Manager

Date

Engineering Consultant Safety Manager

Date

EMERGENCY CONTACTS

The Emergency Contacts should be listed in each of the Site-Specific Work Plans. On arrival at each Site, the list of emergency phone numbers should be verified and posted by the Environmental Leader (EL). In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list. For emergency situations, contact should first be made with the EL who will notify emergency personnel who will then contact the appropriate response teams. The emergency contacts list must be in an easily accessible location at the Site.

ROUTE TO HOSPITAL:

The Route to Hospital will be available in the Site-Specific Work Plan. Upon arrival at the Site before work commences, the directions to the hospital and a route map from the Site must be posted by the EL. Travel time from the Site to the hospital should be estimated. Only in **non-emergency** situations should an injured person be transported to the hospital by means other than an ambulance.

Emergency Contacts

Niagara Mohawk Project Managers:

William R. Jones, PE	315-428-5690 (Office)
Douglas Mayer	315-428-5386 (Office)
Peter Moreau	315-428-6808 (Office)
James F. Morgan	315-428-3101 (Office)
Steven P. Stucker, CPG	315-428-5652 (Office)
Charles F. Willard, PG	315-428-5015 (Office)

Niagara Mohawk Safety Department:

Brian Powell	315-460-1303 (Office)
--------------	-----------------------

Engineering Consultant Safety Manager:

Engineering Consultant Program Manager:

SECTION 1 - INTRODUCTION

1.1 PURPOSE AND REQUIREMENTS

This Generic Environmental Health and Safety Plan (EHS Plan) addresses the health and safety practices that will be employed by all Site workers participating in activities at any Niagara Mohawk Non-owned Former MGP Site. This EHS Plan takes into account the typical hazards inherent to this type of Site and activities, and presents procedures to be followed by Engineering Consultant personnel (Engineering Consultant), its subcontractors, and all other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. Activities performed under this Generic EHS Plan will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926. Modifications to the Generic EHS Plan may be made with the approval of the Safety Manager using the Change Request Form provided in Appendix A.

This Generic EHS Plan assigns responsibilities, establishes standard operating procedures (SOPs), and provides for contingencies that may arise while operations are being conducted at these Niagara Mohawk Non-owned Former MGP Sites.

The provisions of the plan are mandatory for all on-site personnel. All personnel shall abide by this plan. Subcontractors may prepare their own Generic EHS Plans to be reviewed and approved by the Engineering Consultant Safety Manager, but they must conform to this Plan at a minimum.

All personnel who engage in project activities must be familiar with this Generic EHS Plan and comply with its requirements. These personnel must sign-off on the Plan Acceptance Form (Appendix A) prior to beginning work on the Site. The Plan Acceptance Form must be submitted to the Engineering Consultant Safety Manager.

The Engineering Consultant Safety Manager shall review each individual Site to be investigated and the specific activities planned for the Site Investigation and shall address health and safety issues unique to that Site or not fully covered by the Generic EHS Plan in the Site-Specific Work Plan. If necessary, modifications to this Generic EHS Plan shall also be made by the Engineering Consultant Safety Manager to address Site-specific factors.

1.2 SITE DESCRIPTION

This information is provided in the Site-Specific Work Plan.

1.2.1 Summary of Site Conditions

This information will be found in the Site-Specific Work Plan.

1.3 SCOPE OF WORK

The following list is a summary of field activities, which may be implemented as part of the Site Characterization (SC) or Remedial Investigation (RI) at Niagara Mohawk Non-owned Former MGP Sites. Further details are provided in the Site-Specific Work Plan.

- Soil gas sampling
- Drilling and Well Installation
- Excavation of test pits
- Geophysical investigation
- Abandoned underground pipe sampling
- Tank investigation
- On and off site investigation
- Indoor air monitoring and sampling
- Water and sediment sampling

1.4 PROJECT TEAM ORGANIZATION

This section specifies the Project Organization.

1.4.1 Engineering Consultant Project Manager (PM)

The PM responsibilities typically include:

- Ensuring the identification of Site-Specific Work Plans during the planning phase of the project;
- Ensuring that the Generic EHS Plan and the Site-Specific Work Plans have the required approvals before any Site work is conducted; and
- Ensuring that the SM or EL is informed of project changes, which require modifications to the Generic EHS Plan.

1.4.2 Engineering Consultant Safety Manager (SM)

The Safety Manager (SM) responsibilities typically include:

- Ensuring that the Generic EHS Plan is reviewed by personnel with the appropriate regulatory knowledge;
- Approving the individual who is assigned as the EL for the project;
- Ensuring that the Generic EHS Plan addresses the EHS risks and regulatory requirements for the project;
- Reviewing the Site-Specific Work Plan;
- Ensuring that the EL understands the requirements of the Generic EHS Plan;
- Provides for the development and approval of the Generic EHS Plan;

- Serves as the primary contact to review health and safety matters that may arise;
- Approves revised or new safety protocols for field operations;
- Coordinates revisions of this Generic EHS Plan with field personnel; and
- Assists in the investigation of all incidents.

1.4.3 Engineering Consultant Environmental Leader

The EL is a person knowledgeable in appropriate safety and health regulations with at least one year of experience or specialized training in serving in an H&S staff role on hazardous waste remediation sites. The EL's responsibilities typically include:

- Ensures that the Generic EHS Plan is implemented in conjunction with the SM;
- Ensures all information is added to the plan in a timely manner as it becomes available;
- Ensures that field work is scheduled with adequate personnel and equipment resources to complete the job safely;
- Ensures that emergency phone numbers have been developed in the Site-Specific Work Plans and are posted and maintained and that adequate telephone communication between field crews and emergency response personnel is maintained;
- Ensures that field Site personnel are adequately trained and qualified to work at the Site;
- Enforces Site health and safety rules;
- Conducts daily safety briefings;
- Investigates all incidents;
- Conducts weekly Site inspections;
- Completes and maintains Accident/Incident Report Forms;
- Conducting Generic EHS activities specified in Generic EHS Plan, as assigned;
- Identifying new information and/or operational changes which require modifications to the Generic EHS Plan;
- Ensuring that plan modifications are documented and are approved by the SM;
- Ensures that proper personal protective equipment is utilized by field teams;
- Monitors compliance with this Generic EHS Plan;
- Notifies SM of all accidents/incidents;
- Determines upgrade or downgrade of personal protective equipment (PPE) based on Site conditions and/or real-time monitoring results;
- Ensures that monitoring instruments are calibrated;

- Reports to SM to provide summaries of field operations and progress; and
- Maintains health and safety data in the field logbooks.

1.4.4 Site Personnel

Site personnel shall report any unsafe or potentially hazardous conditions to the EL, also:

- Maintain knowledge of the information, instructions and emergency response actions contained in the Generic EHS Plan and the Site-Specific Work Plan
- Comply with rules, regulations and procedures as set forth in this SHSP and any revisions
- Prevent admittance to work sites by unauthorized personnel
- Inspect all tools and equipment, including PPE, daily prior to use

SECTION 2 - RISK ANALYSIS

2.1 CHEMICAL HAZARDS

Compounds that typically may be encountered while conducting remedial investigation at this Site or any former MGP Site include polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethyl benzene and xylene (BTEX); and cyanide salts. Specific compounds and their relevant properties are shown in Table 2-1 (see Appendix B).

In addition to the compounds on-site, some of the solvents used in the processing of samples and for the decontamination of equipment are potentially hazardous to human health if not used properly. In addition to the chemical hazards existing at the Site, additional chemical hazards may be present due to materials being brought to the Site, such as acids/organic compounds, and decontamination fluids. Prior to working with these materials on-site, MSDSs shall be obtained and reviewed by all potentially affected personnel. A copy of all MSDSs shall be available at the Site location.

2.2 PHYSICAL HAZARDS

Most safety hazards are discussed in the Activity Hazard Analysis (AHA) in Appendix E for the different phases of the project. In addition to the AHAs, general work rules and other safety procedures are described in Section 6.1 of this Generic EHS Plan.

2.2.1 Heat Stress

Site activities may take place during time periods where exposure to temperature extremes could occur. In order to minimize exposure to temperature extremes, Site personnel shall be familiar with the health effects of exposure to temperature extremes and the control measures that can minimize exposure. Procedures for monitoring and prevention may be found in Appendix F.

2.2.2 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps and generators. All employees routinely working within 10 feet of these operations will wear hearing protection. All employees are to receive a pre-employment audiogram as part of their physical examination. High noise areas shall be so designated.

2.2.3 Drill Rig Operations

In order to install monitoring wells and soil borings, a hollow-stem auger-drilling rig will be used. Working with or near this equipment poses many potential hazards, including being struck by or against, or pinched/caught by, that can result in serious physical harm. All employees will be briefed on the potential hazards prior to the start of the job.

2.2.4 Hand and Power Tool Usage

In order to complete the various tasks for the project, hand and power tools may be utilized. 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. A ground fault current interrupter (GFCI) shall be used with all power tools used on-site.

2.2.5 Fire and Explosion

The use of a drill rig, diesel engine, steam cleaners and tools that are gasoline powered presents the possibility of encountering 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 will be called and underground utilities will be located and marked, on private property a private locating service will be used and/or a geophysical survey will be conducted. In the event a pipe or line is struck, work will stop and the emergency response plan will be implemented. Additionally, diesel fuel and gasoline shall be stored in metal cans with self-closing lids and flash arrestors.

2.2.6 Slips, Trips, and Falls

Working in and around the Site may pose slip, trip and fall hazards due to potentially slippery surfaces and uneven terrain. Potential adverse health effects include falling to the ground and becoming injured or twisting an ankle.

2.2.7 Manual Lifting

Manual lifting of heavy objects will be required for several tasks. Workers will be trained on proper lifting and getting help. Not following proper lifting technique can result in back injuries and strains. Back injuries are a serious concern as they are the most common workplace injury, often resulting in lost or restricted work time, and long treatment and recovery periods.

2.2.8 Steam, Heat, and Splashing

Exposure to steam/heat/splashing hazards can occur during steam cleaning operations and sampling activities. Exposure to steam/heat/splashing can include scalding/burns, eye injury, and puncture wounds. PPE will include ANSI approved safety glasses, face shield whenever splashing is involved and Tyvek or Poly/Saran coveralls.

2.2.9 Traffic and Road Hazards

Speed limit for traffic is 15 mph for all areas of the site except the main road where the speed limit is 25 mph.

- Personnel are not allowed to use a cellular phone while driving a vehicle on-site.
- Use flagmen or spotters for traffic control whenever there is work on or along a roadway, heavy or congested traffic, "blind spots", or where there are road hazards or unsafe road conditions. Flagmen must use flags/sign paddles that are 18" x 18" square minimum. For projects requiring work affecting traffic on public roads, including temporary lane closures, a traffic control plan shall be prepared in accordance with the requirements contained in the Manual on Uniform Traffic Control Devices for Streets and Highways (available for purchase at <http://mutcd.fhwa.dot.gov/ser-pubs.htm>).
- The temporary traffic control zone includes the entire section of roadway between the first advance warning sign through the last traffic control device, where traffic returns to its normal path and conditions. Most temporary traffic control zones can be divided into four areas: the advance warning area, the transition area, the activity area, and the termination area.
- In the advance warning area, drivers are informed of what to expect. The advance warning may vary from a single sign or flashing lights on a vehicle to a series of signs in advance of the temporary traffic control zone transition area. On freeways and expressways, where driver speed is generally in the higher range (45 mph or more), signs may be placed from 500 feet to 1/2 mile or more before the temporary traffic control zone.
- Transition Area - When redirection of the driver's normal path is required, traffic must be channeled from the normal path to a new path. This redirection is intended to occur at the beginning of the transition area. In mobile operations, this transition area moves with the workspace. Transition areas usually involve strategic use of tapers. (Tapers are cones used in a pattern to direct traffic, see Section 6 of MUTCD.)
- Activity Area - The activity area is an area of roadway where the work takes place. It is composed of the workspace and the traffic space, and may contain one or more buffer spaces.
- Termination Area - The termination area is used to return traffic to the normal traffic path. The termination area extends from the downstream end of the work area to the End Road Work signs.
- All personnel directly involved with this phase of work will wear high visibility vests, shirts, or jackets at all times.
- Use proper controls to restrict traffic (if necessary) and/or inform personnel in daily tailgate safety meeting.
- Put cones/barriers up at a safe distance, taper the cones from near the shoulder to the lane line to send traffic in that direction and to keep unnecessary traffic out of work area(s).
- Do not approach heavy equipment unless eye contact with appropriate hand signals has been made with the operator to cease activity. Equipment operators shall confirm that

eye contact had been made by stopping operation and clearly showing their hands are off of the controls.

2.2.10 Confined Space Entry

Follow OSHA 1910.146 confined space procedure including air monitoring and instrument calibration. No confined space entry should be made if there is any other feasible method for doing the job. If a confined space entry must be made, planning and training with the fire department for possible rescue of confined space entrants must be accomplished prior to the confined space entry. Determine if the confined space is a permit required confined space. If the confined space is a permit required confined space, the permit must be filled out and all conditions addressed prior to entry. Purging and ventilation must be conducted to remove hazardous atmospheres if they are detected by air monitoring.

"Confined space," means a space that:

- (1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- (2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and
- (3) Is not designed for continuous employee occupancy.

A Permit Required Confined Space is a confined space which has one or more of the following characteristics:

- (1) Contains or has the potential to contain a hazardous atmosphere
- (2) Contains a material that has the potential to engulf the entrant
- (3) Has an internal configuration that could trap or asphyxiate an entrant

2.2.11 Boating and Water Safety

Follow Coast Guard safety regulations. Boat should be equipped with at least 1 pair of oars, throwing ring with at least 50' of line, Personal Floatation Devices (PFDs) for each person onboard, 1 Ball-end Boat hook, tie-up line, tool kit, a 10 pound minimum ABC type fire extinguisher, flashlight, air horn, anchor. File a float plan before you leave the shore. Nobody will stand in the boat while underway or docking.

2.3 BIOLOGICAL HAZARDS

During the course of the project, there is a potential for workers to come into contact with biological hazards such as animals, insects and plants. The Activity Hazard Analysis found in Appendix E will include specific hazards and control measures for each task.

2.3.1 Animals

During Site operations, animals such as dogs, cats, mice and snakes may be encountered. Workers shall use discretion and avoid all contact with animals. If these animals present a problem, efforts will be made to remove these animals from the Site by contacting a licensed pest control technician.

2.3.2 Insects

Insects, such as mosquitoes, ticks, bees and wasps may be present during certain times of the year. Workers will be encouraged to wear repellents when working in areas where insects are expected to be present. If insects are prevalent, efforts will be made to remove them from the Site by contacting a licensed pest control technician.

2.3.2.1 Lyme Disease

Since the site is located in the northeast, the potential for coming into contact with deer ticks exists. Lyme disease is caused by an infection from a deer tick that is about the size of the head of a pin. After a blood feeding, the tick becomes engorged and may vomit its stomach contents into the host, a microorganism (spirochete) may be transmitted into the bloodstream that may lead to Lyme disease. The feeding time is 24 to 48 hours. The effects of the disease vary from person to person, which often makes it difficult to diagnose. Typically, the incubation period ranges from two days to two weeks. In most cases, the infected area will resemble a red bull's eye with concentric rings. Within the same period, flu-like symptoms may develop. If left untreated, the red ringed area will eventually fade and Lyme disease may further develop into an arthritis-like condition.

The best method for stopping insect borne disease is to avoid the bite. Control measures to prevent Lyme Disease include the following:

- Avoid dense or high brush, when possible
- Wear light colored clothing
- Spray DEET on your skin and Permethrin on clothing and work boots
- Tuck pant legs into socks and shirts into gloves, if possible
- Self/Buddy check of neck, hairline, groin and body after working in areas that may contain deer ticks
- Wear light colored tyvek or clothing
- Wear booties over work boots
- Look for ticks upon returning from field work
- Shower As Soon As Possible
- If a tick is found, suffocate it with baby oil applied to the tick, then remove it by pulling gently at the head with tweezers or better, the Pro-Tick removal system. (See below.)
- Report any of the above symptoms and all tick bites to the SHSO for evaluation. Employees bitten by deer ticks during the course of employment, or one who finds an engorged tick on their body, will be given a medical examination.

Analysis of the tick for Spirochete may be warranted. Administration of antibiotic therapy may be warranted.

4.2.2 Plants

Plants such as poison ivy and poison oak may be prevalent at the site during certain times of the year. Workers will be trained to recognize these plants and to minimize contact with them. Employees may wear PPE in order to reduce the potential for exposure. Pre-exposure topical lotions, such as Tecuu, may be applied prophylactically. "Ivy Block" is an easy to use non-prescription, pre-exposure lotion. You apply it like sunscreen to all exposed skin. It dries quickly and the active ingredient, bentoquatam, guards you against the harmful oil in poison ivy, oak and sumac. Remove lotion with running water and soap after risk of exposure has ended. Toll FREE ORDER LINE (800) 421-1223.

The use of Clorox wipes to decontaminate reusable clothing to preclude exposure to poison ivy may prove valuable. Gloves should be worn during decontamination and removal of PPE.

SECTION 3 – MEDICAL MONITORING AND PERSONNEL PROTECTION

3.1 MEDICAL MONITORING

All contractor and subcontractor personnel performing field work where potential exposure to contaminants exists at the Site are required to have passed a medical surveillance examination in accordance with 29 CFR 1910.120(f).

A medical examination shall be administered and shall include a medical and work history and a standard occupational physical, examination of all major organ systems, complete blood count with differential (CBC), and a SMAC/23 blood chemistry screen which includes calcium, phosphorous, glucose, uric acid, BUN, creatinine, albumin, SGPT, SGOT, LDH, globulin, A/G ratio, alkaline phosphatase, total protein, total bilirubin, triglyceride, cholesterol, and a creatinine/BUN ratio. Additionally a pulmonary function test will be performed by trained personnel to record Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second (FEV1.0). An audiogram and visual acuity measurement, including color perception, is provided.

A physician's medical release for work will be confirmed by the EL before an employee can work in the exclusion zone. The examination will be taken annually at a minimum and upon termination of hazardous waste site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the SM in consultation with the EL if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other Site conditions warrant further medical surveillance.

3.1.1 Medical Data Sheet

A medical data sheet is provided in Appendix A. This medical data sheet is voluntary and should be completed by all on-site personnel and will be maintained at the Site. Where possible, this medical data sheet will accompany the personnel needing medical assistance. The medical data sheet will be maintained in a secure location, treated as confidential, and used only on a need-to-know basis.

TABLE 3-1
PERSONAL PROTECTIVE EQUIPMENT SELECTION

TASK	HEAD	EYE/ FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR
Mobilization/demobilization	HH	SG	STB	LWG	Work	EP as needed	Level D
Soil Gas sampling	HH	SG	STB	LWG	Work	EP as needed	Level D
Well Drilling	HH	SG	STB	LWG	Work	EP as needed	Level D
Geophysical investigation	HH	SG	STB	LWG	Work	EP as needed	Level D
Excavation of test pits	HH	SG	STB, OB	LWG	Tyvek	EP as needed	Level D*
Abandoned underground pipe sampling	HH	SG	STB, OB	Nit, Sur	Tyvek or Poly	EP as needed	Level D *
Tank investigation	HH	SG	STB, OB	Nit, Sur	Tyvek or Poly	EP as needed	Level D*
Indoor air monitoring	HH	SG	STB, OB	LWG	Tyvek	EP as needed	Level D*
Water and Sediment sampling	HH	Goggles	STB, OB	Nit, Sur	Tyvek or Poly	None	Level D*
On and off site investigation	HH	SG	STB	LWG	Work	EP as needed	Level D
Heavy equipment decontamination	HH	PFS with SG or sp. gog.	STB, OB	Nit, Sur	Poly	EP as needed	Level D
HEAD PROTECTION HH = Hard Hat HEARING PROTECTION EP = ear plugs RESPIRATORY PROTECTION Level D = No respiratory protection required Level C = Full face air purifying respirator with OV/R-100 cartridges	EYE/FACE PROTECTION PFS = Plastic Face Shield SG = ANSI approved safety glasses with side shields sp. gog. = Splash Goggles BODY PROTECTION Poly = Polyethylene coated tyvek coveralls Tyvek = Uncoated paper tyvek coveralls Work = Work clothes						FOOT PROTECTION OB = Overboot STB = Leather work boots with steel toe. HAND PROTECTION LWG = Leather Work Gloves Nit = Nitrile Sur = Surgical

* Level C if air monitoring indicates action level exceeded.

3.2 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) specified in Table 3-1 represents a hazard analysis for PPE selection. Specific information on the selection rationale for each activity can be found under Section 2.0 and Appendix E-Activity Hazard Analysis. For the purposes of PPE selection, the SM and EL are considered competent persons. The signature on the front of the Generic EHS Plan constitutes certification of the hazard assessment.

As established in this SHSP, the initial level of personal protective equipment (PPE) will be modified Level D for all activities. Sampling data and past experience indicate a relatively low hazard for exposure. Level C PPE may be required if action levels indicate the need to upgrade. For activities not covered by AHAs, the EL will conduct the hazard assessment and select the PPE using the form provided in Appendix A and will certify the assessment by signing the form. PPE selection will be made in consultation with the SM. Modifications for initial PPE selection may also be made by the EL in consultation with the SM using the same form. A written justification for major downgrades will be provided to the SM for approval on a Change Request form. Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulation (29 CFR 1910.134). Cartridges should be changed out on the following schedule:

- Every shift or 8 hours under normal conditions; and
- Every four hours under conditions of high humidity (>85%).

Air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency;
- IDLH concentrations; and
- If contaminant levels exceed designated use concentrations.

3.3 AIR MONITORING REQUIREMENTS

3.3.1 On-site Air Monitoring

The following monitoring instruments will be used during all field operations:

- Photoionization Detector (PID), Photovac Microtip with 10.6 eV probe or equivalent
- Colorimetric detector tubes and pump for Benzene and Hydrogen Cyanide, the tubes for Benzene will only be used if a non-transient reading on the PID indicates the presence of VOCs.
- Dust Meter, MIE Miniram model PDM-3 or MIE PDR or equivalent
- Combustible Gas Indicator (CGI)/Oxygen (O₂) meter, MSA model Five Star or equivalent

All air monitoring equipment will be calibrated and maintained in accordance with Appendix D. Organic vapor concentrations shall be measured continuously using the PID during the sampling and drilling activities. A wind-monitoring device shall be used to enable easy detection of wind direction during all intrusive activities. Organic vapor concentrations shall 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 EL will interpret monitoring results using professional judgment.

Colorimetric detector tubes shall be used to determine the presence of benzene when action levels suggested in Table 3-2 have been exceeded. Use the following Benzene tube (requires double tube): Benzene - Range - 0.5 - 10 ppm, SKC Cat. No. = 810-121SP

A dust meter shall be used to measure airborne particulate matter during intrusive activities. Monitoring will be continuous and readings will be observed over a 15-minute period and recorded every 15 minutes for comparison with the action levels.

A CGI/O₂ meter shall be used to monitor for combustible gases and oxygen content in the boreholes and surrounding areas and elsewhere as necessary. During drilling operations, combustible gas readings shall be collected each time the auger bit is removed from the borehole.

The National Institute for Occupational Safety and Health (NIOSH) has established guidelines concerning the action levels for work in a potentially explosive environment. These guidelines are as follows:

- 10% LEL- Limit all activities to those which do not generate sparks.
- 20% LEL- Cease all activities in order to allow time for the combustible gases to vent.

Confined space entry requires stop work and exit at 10% LEL.

**TABLE 3-2
ACTION LEVELS**

Instrument	Reading	Level of Respiratory Protection/Action
HCN Monotox unit or tube	< 3 ppm Alarm at 3 ppm or greater	D B
PID	Bkg - < 1 ppm, NT* above background (Bkg) in breathing zone (Bz)	D
PID	> 1 ppm, NT above bkg in Bz	Use detector tube for Benzene.
	1 - 10 ppm confirmed benzene with detector tube	C, notify SM
	1 - 25 ppm, NT above bkg (absence of benzene)	D
PID	> 25 and < 250 ppm, NT above bkg in Bz	C
PID	> 250 ppm, NT above bkg in Bz	B Institute vapor suppression measures

NT = Non Transient

TABLE 3-2
(Continued)

ACTION LEVELS

Instrument	Reading	Level of Respiratory Protection/Action
CGI/O ₂ meter	> 10% LEL, borehole	Proceed with caution
CGI/O ₂ meter	> 20% LEL, borehole	Stop work, allow to vent
CGI/O ₂ meter	> 5% LEL, in Bz	Limit activities to those which do not generate sparks
CGI/O ₂ meter	> 20% LEL, in Bz	Stop work, allow to vent, if levels do not drop below 20% LEL the borehole will be sealed.
CGI/O ₂ meter	< 19.5% O ₂ , in Bz	B
CGI/O ₂ meter	> 23.5% O ₂ , surrounding area or borehole	Stop work and evacuate the work area. Eliminate all ignition sources. Purge borehole if necessary. Identify source of oxygen.
Dust Meter	< 2.5 mg/m ³	D
Dust Meter	>2.5 – 10 mg/m ³ , 15-minute avg. or 1½ x above background	C with R-100 cartridges Institute dust suppression measures
Dust Meter	> 10 mg/m ³ ,	Stop work

If the combustible gases in the well/borehole are not diminished after allowing adequate time to vent, then the following steps should be taken:

- Obtain an air compressor (minimum 1.5 horsepower).
- Place the compressor a safe distance from the well (at least 20 ft.). This precaution is necessary since the compressor is an ignition source.
- Place hose into the well/hole until it reaches bottom.
- Run compressor for 15 minutes.
- Measure the percent LEL in the well/borehole. If the reading continues above 20% LEL, continue to run the compressor. If levels are below 20% LEL, continue to monitor the well/borehole for 5 minutes; if readings remain below 20% LEL, resume drilling, and continue to monitor. If levels do not drop below 20% LEL the borehole will be sealed and work on that well will cease.

3.3.2 Community Air Monitoring Plan

Real-time air monitoring for volatile compounds at the perimeter of the exclusion zone will be conducted. If particulates become a concern at the Site, possibly as a result of drilling activities or wind erosion of soils, this community plan will be modified accordingly. The following procedures will be implemented during field activities as appropriate:

- Volatile organic compounds will be monitored at the downwind perimeter of the exclusion zone on a continuous basis. If total organic vapor levels exceed 5 ppm above background, drilling activities will be halted and monitoring continued under the provisions of the Vapor Emission Response Plan. All readings must be recorded in the field logbook and be available for State (NYSDEC & NYSDOH) personnel to review.
- Particulates will become a concern if visible dust emissions occur from Investigation activities or wind erosion. When particulates become a concern, the following protocol will be followed. Particulates will be continuously monitored downwind of the exclusion zone with a portable real-time particulate monitor that will have an alarm set at 2.5 mg/m^3 . If downwind particulate levels integrated over a period of 15 minutes exceed 2.5 mg/m^3 , then particulate levels upwind of the exclusion zone will be measured. If the downwind particulate level is more than two and one half times greater than the upwind particulate level, then drilling activities will be stopped and corrective action taken. All readings will be recorded in the field logbook and be available for State (NYSDEC & NYSDOH) personnel to review. These action levels can be modified with the agreement of NYSDOH & NYSDOH if particulates are better characterized and identified.

Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 25 ppm above background levels at the perimeter of the exclusion zone with no Benzene present, drilling activities will cease and monitoring continued. If the organic vapor level decreases below 25 ppm (above background), drilling activities may resume. If the organic vapor levels are greater than 25 ppm but less than 50 ppm over background at the perimeter of the work area, activities may resume provided:

- Level C protection is provided to workers in the EZ with Organic Vapor cartridges.
- The organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest residence or commercial structure, whichever is less, is below 25 ppm over background; and
- More frequent intervals of monitoring, as directed by the EL, are conducted.

If the organic vapor level is above 50 ppm over background at the perimeter of the exclusion zone, work activities will halt and odor control contingencies will be implemented. A biodegradable, surfactant-based foam concentrate, such as MSA's VEEfoam, will then be sprayed onto the drill cuttings or excavated soils to control the fugitive vapors. When work shutdown occurs, downwind air monitoring as directed by the EL will be implemented to ensure that vapor emissions do not impact the nearest residential or commercial structure.

If organic vapor levels greater than 25 ppm over background are identified 200 feet downwind from the investigation Site, or half the distance to the nearest residential or commercial property line, whichever is less, all work must cease. If, following cessation of work activities and implementation of odor control contingencies, organic vapor levels persist above 25 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then air quality must be monitored within 20 feet of the perimeter of the nearest residential/commercial structure (the "20 foot zone").

If organic vapor levels approach 25 ppm above background within the "20 foot zone" for a period of more than 30 minutes, or organic vapor levels greater than 50 ppm above background for any time period occur within the "20 foot zone", then the following steps will be taken:

- The local police authorities will immediately be contacted by the EL and advised of the situation.
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the EL.
- All emergency contacts will go into effect as appropriate.
- If readings fail to drop below 25 ppm after 30 minutes the borehole will be sealed.

3.4 WASTE DISPOSAL PROCEDURES

All discarded materials, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard or causing litter to be left on-site. All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for off-site disposal. All non-contaminated materials shall be collected and bagged for appropriate disposal as non-hazardous solid waste. Additional waste disposal procedures may be developed in conjunction with the Engineering Consultant as applicable.

Non-hazardous wastes will be managed in accordance with NYSDEC regulations for solid waste. IDW will be containerized, characterized and disposed within ninety days in accordance with applicable regulations. If RCRA hazardous wastes are generated which require off-site disposal, they will be managed in accordance with RCRA and NYSDEC regulations and this Generic EHS Plan will be amended to include all applicable requirements for hazardous waste management.

All disposal facilities and transporters used for off-site disposal will be approved by Niagara Mohawk prior to use. The Engineering Consultant will prepare all waste documentation (profiles, Bills of Lading, manifests) for review and signature but personnel will not sign any waste documentation unless written authorization is provided by Niagara Mohawk.

SECTION 4 - WORK ZONES AND DECONTAMINATION

4.1 SITE WORK ZONES

To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, zones will be delineated at the Site. The flow of personnel between the zones should be controlled. The establishment of the work zones will help ensure that personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency.

4.1.1 Exclusion Zone

Exclusion zones will be established at the Site for all drilling activities; unprotected onlookers should be located 50 feet upwind of drilling or soil sampling activities. In the event that volatile organics are detected in the breathing zone as discussed in Section 3.3, all personnel within the exclusion zone must don Level C protection. Exclusion zones will also be established during any activity when Level C protection is established as a result of conditions discussed in Section 3.0.

All personnel within the exclusion zone will be required to use the specified level of protection. No eating, drinking, or smoking will be allowed in the exclusion or decontamination zones.

4.1.2 Decontamination Zone

If appropriate, a decontamination zone will be established between the exclusion zone and the support zone, and will include the personnel and equipment necessary for decontamination of equipment and personnel (discussed below). Personnel and equipment in the exclusion zone must pass through this zone before entering the support zone. This zone should always be located upwind of the exclusion zone.

4.1.3 Support Zone

The support zone will include the remaining areas of the job site. Break areas, operational direction and support facilities (to include supplies, equipment storage and maintenance areas) will be located in this area. No equipment or personnel will be permitted to enter the support zone from the exclusion zone without passing through the personnel or equipment decontamination station. Eating, smoking, and drinking will be allowed only in this area.

4.2 DECONTAMINATION

Any water used in decontamination procedures will be containerized on-site and sampled before off-site transportation and disposal.

4.2.1 Decontamination of Personnel

The need for decontamination will be determined by the EL. Minimum decontamination may be necessary if only Level D protection is used. However, at a minimum, disposable gloves used during sampling activities should be removed and bagged; personnel will be encouraged to remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel will wash hands and face prior to eating and before and after using the restroom.

Decontamination will be necessary if Level C protection is used. The following OSHA-specified procedures include steps necessary for complete decontamination prior to entry into the support zone, and steps necessary if a worker only needs to change a respirator or respirator canister.

Modification can be made to the twelve-station decontamination process by the ESS depending upon the extent of contamination.

Station 1: Segregated Equipment Drop

Deposit equipment used on the Site (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Station 2: Suit/Safety Boot and Outer-Glove Wash

Thoroughly wash chemically resistant suit, safety boots and outer gloves. Scrub with long-handle, soft-bristle scrub brush and copious amounts of Alconox/water solution. Necessary equipment includes:

1. Wash tub (30 gallon or large enough for person to stand in)
2. Alconox/water solution
3. Long-handle soft-bristle scrub brushes

Station 3: Suit/Safety Boot and Outer-Glove Rinse

Rinse off Alconox/water solution using copious amounts of water. Repeat as many times as necessary. Necessary equipment includes:

1. Wash tub (30 gallon or large enough for person to stand in)
2. Spray unit
3. Water

4. Long-handle, soft-bristle scrub brushes

Station 4: Outer Gloves Removal

Remove the outer gloves and deposit in individually marked plastic bags. Necessary equipment includes:

1. Plastic bag

Station 5: Canister or Mask Change

If a worker leaves the exclusion zone to change a canister (or mask), this is the last step in the decontamination procedures. The worker's canister is exchanged, new outer glove donned, and joints taped. Worker returns to duty. Otherwise the worker proceeds to Station 6. Necessary equipment includes:

1. Canister (or mask)
2. Tape
3. Gloves

Station 6: Removal of Chemically Resistant Suit

With assistance of helper, remove suit. Deposit in container with plastic liner. Necessary equipment includes:

1. Container with plastic liner

Station 7: Inner-Glove Wash

Wash inner gloves with Alconox/water solution that will not harm skin. Repeat as many times as necessary. Necessary equipment includes:

1. Alconox/water solution
2. Wash tub
3. Long-handle, soft-bristle brushes

Station 8: Inner-Glove Rinse

Rinse inner gloves with water. Repeat as many times as necessary. Necessary equipment includes:

1. Water
2. Wash tub

Station 9: Respirator Removal

Remove face-piece. Avoid touching face. Wash respirator in clean, sanitized solution, allow to dry, and deposit face-piece in plastic bag. Store in clean area. Necessary equipment includes:

1. Plastic bags
2. Sanitizing solution
3. Cotton

Station 10: Inner-Glove Removal

Remove inner gloves and deposit in container with plastic liner. Necessary equipment includes:

1. Container with plastic liner

Station 11: Field Wash

Wash hands and face. Necessary equipment includes:

1. Water
2. Soap
3. Tables
4. Wash basins or buckets
5. Clean towels

Station 12: Redress

If re-entering exclusion zone put on clean field clothes (e.g., Tyvek, gloves, etc.). Necessary equipment includes:

1. Table
2. Clothing

4.2.2 Decontamination of Equipment

Drill rigs and backhoes will have gross contamination removed by manual scraping or brushing, then be steam cleaned and drilling equipment will be decontaminated prior to moving to a Site. Drilling equipment used for multiple boreholes and the back of backhoes used for test pit excavation will be decontaminated prior to drilling each boring/digging each test pit at the Site. The equipment will be decontaminated in the following manner:

- The drill rig/backhoe will have gross contamination manually removed by scraping then be steam cleaned.
- Down-hole equipment (auger bits, drill rods, split-spoons, etc.) will be steam cleaned and air dried to remove gross contamination.
- Surface equipment, such as field meters and surveying instruments, will be wiped with a clean, damp cloth.
- All decontamination will take place only on the Decon Pad.

A drilling sequence hierarchy (from less impacted to more impacted boring locations) will be followed to minimize the potential for cross contamination.

SECTION 5 - SAMPLE SHIPMENT

Samples collected in the Investigation, with the exception of any drum samples, tank samples, or other concentrated wastes, will be classified as environmental samples. In general, environmental samples are collected from streams, ponds, or wells and are not expected to be grossly contaminated with high levels of hazardous materials. The sample tag or label will be legibly written and completed with an indelible pencil or waterproof ink. The information will also be recorded in a field logbook. As a minimum, it will include:

- Exact location of sample
- Time and date sample was collected
- Name of sampler witnesses (if necessary)
- Project codes, sample station number, and identifying code (if applicable).
- Type of sample (if known)
- Laboratory number (if applicable)
- Any other pertinent information

5.1 ENVIRONMENTAL SAMPLES

Environmental samples will be packaged and shipped via courier and/or overnight carrier according to the following procedure:

Packaging

1. Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal bag.
2. Place sample in a fiberboard container or plastic cooler that has been lined with a large polyethylene bag.
3. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking.
4. Seal large bag.
5. Seal or close outside container.

Marking/Labeling

Sample containers must have a completed sample identification label and the outside container must be marked "Environmental Sample." The appropriate side of the container must be marked

"This End Up" and arrows should be drawn accordingly. No DOT marking labeling is required.

Shipping Papers

No DOT shipping papers are required.

Transportation

There are no DOT restrictions on mode of transportation.

5.2 HAZARDOUS SAMPLES

Drum samples, tank samples, sludge samples, and grossly contaminated soil samples will be shipped as DOT Hazardous Materials. The designation "Flammable Liquid" or "Flammable Solid" will be used. The samples will be transported as follows:

1. Collect sample in a 16-ounce or smaller glass or polyethylene container with nonmetallic teflon-lined screw cap. Allow sufficient air space (approximately 10% by volume) so container is not liquid full at 54°C (130°F). If collecting a solid material, the container plus contents should not exceed one pound net weight. If sampling for volatile organic analysis, fill VOA container to septum but place the VOA container inside a 16-ounce or smaller container so the required air space may be provided. Large quantities, up to 3.786 liters (1 gallon), may be collected if the sample's flash point is 23°C (75°F) or higher. In this case, the flash point must be marked on the outside container (e.g., carton, cooler), and shipping papers should state that "Flash point is 73°F or higher."
2. Seal sample and place in a 4-mil-thick polyethylene bag, one sample per bag.
3. Place sealed bag inside a metal can with noncombustible, absorbent cushioning material (e.g., vermiculite or earth) to prevent breakage, one bag per can. Pressure-close the can and use clips, tape or other positive means to hold the lid securely.
4. Mark the can with:
 - Name and address of originator
 - "Flammable Liquid N.O.S. UN 1993" (or "Flammable Solid N.O.S. UN 1325")
NOTE: UN numbers are now required in proper shipping names.
5. Place one or more metal cans in a strong outside container such as a picnic cooler or fiberboard box. Preservatives are not used for hazardous waste Site samples.
6. Prepare for shipping:

"Flammable Liquid, N.O.S. UN 1993" or "Flammable Solid, N.O.S. UN 1325"; "Cargo Aircraft Only (if more than 1 quart net per outside package); "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight xxxx" or "Net Volume yyyy" (of hazardous contents) should be indicated on shipping papers and on outside of shipping container. "This Side Up" or "This End Up" should also be on container. Sign shipper certification.

7. Stand by for possible carrier requests to open outside containers for inspection or modify packaging. It is wise to contact the overnight carrier before packing to ascertain local packaging requirements and not to leave area before the carrier vehicle (aircraft, truck) is on its way.

SECTION 6 - ACCIDENT PREVENTION AND CONTINGENCY PLAN

6.1 ACCIDENT PREVENTION

All field personnel will receive health and safety training prior to the initiation of any Site activities. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, regular meetings should be held. Discussion should include:

- Tasks to be performed.
- Time constraints (e.g., rest breaks, cartridge changes).
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- Emergency procedures.

6.1.1 Drilling

Prior to any drilling activity, efforts will be made to contact the Underground Facilities Protective Organization (UFPO) to determine whether underground installations will be encountered and, if so, where these installations are located. Hard hats, safety glasses, and safety boots must as a minimum be worn within 50 feet of the drill rig. The drill rig cannot be operated within 10 feet of power lines. The EL will provide constant on-site supervision of the drilling subcontractor to ensure that they are meeting the health and safety requirements. If deficiencies are noted, work will be stopped and corrective action will be taken (e.g., retrain, purchase additional safety equipment). Reports of health and safety deficiencies and the corrective action taken will be forwarded to the Safety Manager.

6.1.2 Vehicles and Heavy Equipment

Working with large motor vehicles and heavy equipment could be a major hazard at this Site. Injuries can result from equipment hitting or running over personnel, impacts from flying objects, or overturning of vehicles. Vehicle and heavy equipment design and operation will be in accordance with 29 CFR, Subpart O, 1926.600 through 1926.602. In particular, the following precautions will be utilized to help prevent injuries/accidents.

- All items affecting safety such as brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, back up alarm, tires and other safety items will be checked at the beginning of each shift.

- Large construction motor vehicles will not be backed up unless:
 1. The vehicle has a reverse signal alarm audible above the surrounding noise level; or
 2. The vehicle is backed up only when an observer signals that it is safe to do so.
- Heavy equipment or motor vehicle cable will be kept free of all nonessential items, and all loose items will be secured.
- Large construction motor vehicles and heavy equipment will be provided with necessary safety equipment (seat belts, roll-over protection, emergency shut-off in case of roll-over, backup warning lights and audible alarms).
- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicles.

6.2 CONTINGENCY PLAN

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential.

6.2.1 Responsibilities

6.2.1.1 *Safety Manager (SM)*

The SM oversees and approves the Emergency Response/Contingency Plan and performs audits to determine that the Generic EHS Plan is in effect and that all pre-emergency requirements are met. The SM acts as a liaison to applicable regulatory agencies.

6.2.1.2 *Emergency Coordinator (EC)*

The Emergency Coordinator (EC) is the Environmental Leader. The EC will be a person knowledgeable in emergency response procedures at hazardous waste remediation sites. The Emergency Coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on-site. The Emergency Coordinator shall make necessary arrangements to be prepared for any emergencies that could occur. The EC shall also coordinate with management of Niagara Mohawk to ensure that the procedures contained herein do not conflict with the Niagara Mohawk emergency program.

The Emergency Coordinator shall implement the Emergency Response/Contingency Plan whenever conditions at the Site warrant such action. The coordinator will be responsible for prior coordination of the emergency treatment and emergency transport of Site personnel as necessary, and notification of emergency response units and the appropriate management staff.

The EC is responsible for seeing that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The EC is required to immediately notify the PM and SM of any fatalities or catastrophes.

6.2.1.3 Site Personnel

Site personnel are responsible for knowing the Emergency Response/Contingency Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of impending or actual emergencies, and to cooperate fully once the Plan is enacted. All information obtained about an emergency shall be immediately communicated to the Emergency Coordinator.

6.2.2 Communications

A variety of communication systems may be utilized during emergency situations. These are discussed in the following sections.

6.2.2.1 Telephone Communications

The primary form of communication during an emergency between the Site and outside emergency response groups will be telephone communications. The location of the nearest public telephone or cellular phone shall be determined and all Site personnel shall be made aware of its location and use prior to the start of Site operations.

6.2.2.2 Air Horns

Air horns will be used to alert Site personnel of emergencies. The following signals will be used:

- Two short blasts - shut down equipment, clear radio channels, await instructions
- Three short blasts - injured employee, first-aid providers respond
- One continuous blast - Site evacuation

Air horns can be found at the support area and with each field team. The procedure to activate the air horns consists of depressing the air horn button or switch while pointing it in the direction of the area to be signaled. Air horns should be tested at least monthly to ensure that they are working properly.

6.2.2.3 Hand Signals

Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during Site-specific training. Typical hand signals are the following:

SIGNAL

Hand gripping throat
Grip on a partner's wrist or placement of both hands
around a partner's waist
Hands on top of head
Thumbs up
Thumbs down

MEANING

Out of air, can't breathe
Leave the area immediately, no
debate
Need assistance
Okay, I'm all right, I understand
No, negative

6.2.3 Emergency Equipment

The following emergency equipment shall be available at the Site:

- 10 lb. ABC fire extinguisher;
- Industrial size first aid kit; and
- Portable eyewash that meets ANSI requirements for a 15 minute flush.

6.2.4 Evacuation

Under certain circumstances, it may become necessary for all personnel to leave the Site for a time period. Such circumstances may include violent storms, explosion or fire.

An evacuation route map and rally point will be posted on a map in the command post area. Evacuation drills will be held periodically to check response of workers.

When it is determined that an evacuation is warranted, the Emergency Coordinator shall issue an evacuation command. At this time, all Site personnel shall terminate current operations in an orderly fashion as is practicable, perform decontamination procedures (if possible), and proceed to the pre-determined assembly location.

6.2.5 Potential Emergency Situations and Procedures

6.2.5.1 Potential or Actual Fire or Explosion

In the event of a fire or explosion:

Site Personnel shall:

- Immediately stop work;
- Decontaminate (if possible); and
- Immediately evacuate the Site, proceed to the pre-determined assembly point.

The **Emergency Coordinator** shall immediately notify the facility liaison, and other appropriate emergency response groups if an actual fire or explosion has taken place.

6.2.5.2 Personnel Injury

In the event of a personnel injury:

Site Personnel shall:

- Apply first aid as appropriate;
- Decontaminate the victim to the greatest extent possible;
- Transport the victim to the support zone (if the victim is unable to walk); and
- Complete an accident/incident report.

The **Emergency Coordinator** shall contact emergency medical services.

The ambulance/rescue squad shall be contacted for transportation to the hospital as necessary in an emergency situation. However, since some situations may require transport of an injured party by other means, a hospital route in the Site-Specific Work Plan shall be reviewed by the EC prior to the startup of operations. The map will be drawn for each Site and posted in the field team vehicle. Only in **non-emergency** situations shall an injured person be transported to the hospital by means other than an ambulance.

6.2.5.3 Overt Personnel Exposure

Situations may arise when personnel are overtly exposed to chemical hazards via inhalation, skin contact or ingestion. In the event of an overt personnel exposure:

Site Personnel shall follow these procedures:

For Skin Contact

- Use copious amounts of water;
- Wash/rinse affected area thoroughly; and
- Apply appropriate first aid.

For Eye Contact

- Begin using emergency eyewash;
- Call for a vehicle to transport the victim; and
- Transport immediately to SZ, **do not** decontaminate.

For Inhalation

- Move to fresh air.

For Ingestion

- Determine, if possible, what chemical was ingested;
- Contact the poison control center;
- Follow poison control center guidelines; and
- Decontaminate and transport to emergency medical facility.

For a Puncture Wound or Laceration

- Apply appropriate first aid; and
- If necessary, decontaminate and transport to emergency medical facility.

The Emergency Coordinator shall:

- Contact outside emergency services immediately for eye contact and ingestion; and
- Contact the poison control center regarding an ingestion as soon as possible.

6.2.5.4 Adverse Weather Conditions

Site activities will be limited to daylight hours unless adequate lighting is provided. All Site activities will be limited to acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate, if necessary, in case of inclement weather conditions.

In the event of adverse weather conditions, the EL or designee will determine if work can continue without jeopardizing the health and safety of the workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries
- Potential for cold stress and cold-related injuries
- Treacherous weather-related working conditions
- Limited visibility
- Potential for electrical storms.

Storms

The EL will monitor weather service advisories to determine when other adverse weather conditions may develop. These conditions may include tornadoes, electrical storms, thunderstorms, hurricanes, and snowstorms. When it is indicated that the safety of personnel at the Site may be at risk, the EL shall make a determination whether or not to continue work.

6.2.6 Restoration and Salvage

After an emergency, prompt restoration of fire protection equipment, medical supplies, and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Re-filling fire extinguishers;
- Re-filling medical supplies; and
- Re-filling or replacing eyewash containers.

6.2.7 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

1. Program Manager
2. Safety Manager

Written confirmation of verbal reports are to be submitted to the SM within 24 hours by the EL. The report form is to be used for this purpose. All representatives contacted by telephone are to receive a copy of this report. If the employee involved is not a Engineering Consultant employee, his employer shall receive a copy of this report.

For reporting purposes, the term accident refers to fatalities, all injuries (even first aid cases only), spill or exposure to hazardous materials (radioactive materials, toxic materials, explosive or flammable materials), fire, explosion, property damage, or potential occurrence of the above.

6.2.8 Procedures In the Event That Ionizing Radiation is Detected

If radiation is expected to be a problem then work must cease until radiation detection instruments can be obtained for monitoring. Contact SM for assistance and file Change Request to this safety plan. If radiation levels exceed background levels, the EL must consult immediately with the Safety Manager (SM). All OSHA requirements concerning work in an environment containing ionizing radiation (29 CFR 1910.96) must be met. At no time are personnel to work at a Site where whole body dose exceeds 2 mr in any one hour.

SECTION 7 - TRAINING

7.1 GENERAL HEALTH AND SAFETY TRAINING

In accordance with and pursuant to 29 CFR 1910.120, hazardous waste Site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any Site activities in which they may be exposed to hazards (chemical or physical).

7.1.1 Three Day Supervised On the Job Training

In addition to the required initial hazardous waste operations training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

7.2 ANNUAL EIGHT-HOUR REFRESHER TRAINING

Annual eight-hour refresher training will be required of all hazardous waste Site field personnel in order to maintain their qualifications for field work. The training will cover a review of 1910.120 requirements and related company programs and procedures

7.3 SUPERVISORY TRAINING

Supervisors and health and safety personnel shall have completed an additional eight hours of specialized training in accordance with 29 CFR 1910.120.

7.4 SITE-SPECIFIC TRAINING

The EL will be responsible for developing a Site-specific occupational hazard training program and providing training to all personnel that are to work at the Site. Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the Site operations. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. At a minimum, this training shall consist of the following topics:

- Names of personnel responsible for Site safety and health;
- Safety, health, and other hazards at the Site;
- Proper use of personal protective equipment;
- Work practices by which the employee can minimize risk from hazards;
- Safe use of engineering controls and equipment on the Site;
- Acute effects of compounds at the Site; and
- Decontamination procedures.

The training shall also incorporate those practices detailed in Appendix C.

7.5 ON-SITE SAFETY BRIEFINGS

Project personnel and visitors will be given on-site health and safety briefings on a daily basis by the EL to assist Site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the Site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity to periodically update the crews on monitoring results. Prior to starting any new activity, a training session using the Activity Hazard Analysis will be held for crewmembers involved in the activity.

7.6 FIRST AID AND CPR

The SM will identify those individuals requiring first aid and CPR training in order to ensure that emergency medical treatment is available during field activities. It is expected that a minimum of two field personnel on-site at any one time will have first aid, and CPR training. The training will be consistent with the requirements of the American Red Cross Association.

7.7 BLOODBORNE PATHOGENS TRAINING

Individuals on-site who have First Aid and CPR certification and who may provide emergency medical treatment, shall have completed training in Bloodborne Pathogens.

7.8 HAZARD COMMUNICATION

Hazard communication training will be provided in accordance with the requirements contained in OSHA 29 CFR 1910.1200.

7.9 HAZARDOUS WASTE TRAINING

Federal RCRA and State hazardous waste generator regulations require that all employees performing job functions related to hazardous waste be trained. As such, all persons performing job functions related to hazardous waste must be trained. The following training related documentation must be maintained at the Site:

- The job title of each position related to hazardous waste management and the name of the employee filling each position;
- A written job description for each position related to hazardous waste management;

- A written description of the type and amount of training that is given to each person filling a hazardous waste management job description; and
- Records must be kept until closure of the Site.

7.10 USDOT TRAINING

All personnel performing job functions related to the transportation of hazardous materials, including subcontractors, must undergo USDOT HM126-F HAZMAT training prior to performing any job function related to the transportation of any waste from the project Site. This includes, but is not limited to the following:

- Placing hazardous waste in containers;
- Moving or handling hazardous waste;
- Marking and labeling containers;
- Selecting packaging; and
- Determining a USDOT proper shipping name and description for hazardous waste and materials.

APPENDIX A

FORMS FOR HEALTH AND SAFETY-RELATED ACTIVITIES

FORMS FOR HEALTH AND SAFETY-RELATED ACTIVITIES

OSHA Job Safety and Health Protection Poster

Note: The OSHA Job Safety and Health Protection Poster must be posted prominently during field activities. The actual poster must be at least 8 1/2 by 14 inches with 10 point type.

ONLINE ORDER: If you would prefer to obtain a pre-printed copy of this poster, you may do so by submitting your order through the OSHA Online Publications Order Form. Simply select Publication Number 3165 from the list.

Medical Data Sheet

To be completed by all Site personnel. Used in the event of an emergency for information.

Field Team Review /Site-Specific Health and Safety Training Form

Signed by all Site personnel to indicate that they will comply with and understand the provisions of the Generic EHS Plan.

Weekly Health and Safety Report

To be completed by the EL on a weekly basis to summarize Site activities related to health and safety.

Air Monitoring Form

Used to document air-monitoring performed.

Change Request Form

For documenting changes to the Generic EHS Plan. See attached forms.

PPE Selection Form

To be completed for PPE hazard assessment and selection for additional tasks not covered by the Generic EHS Plan.

MEDICAL DATA SHEET

The brief medical data sheet shall be completed by all on-site personnel and will be kept in the Support Zone by the EL as a project record during the conduct of Site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project: _____

Name: _____ Home Telephone: _____

Address: _____

Age: _____ Height _____ Weight _____ Blood Type _____

Name and Telephone Number of Emergency Contact: _____

Drug or Other Allergies: _____

Particular Sensitivities: _____

Do You Wear Contacts? _____

Provide A Check List Of Previous Illnesses: _____

What Medications Are You Presently Using? _____

Do You Have Any Medical Restrictions? _____

Name, Address, And Phone Number Of Personal Physician: _____

PLAN ACCEPTANCE FORM

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the Generic EHS Plan. It is maintained on Site by the EL as a project record.

Each field team member shall sign this section after Site-specific training is completed and before being permitted to work on-site.

I have read, or have been informed of, the Generic Environmental Health and Safety Plan and the Site Specific Work Plan and understand the information presented. I will comply with the provisions contained therein.

[illegible]

WEEKLY HEALTH AND SAFETY REPORT

PROJECT NAME: _____

LOCATION: _____

SITE INFORMATION

Week Ending _____

Hours Worked: Labor: _____ Subs: _____

Check Level of Protection

For the week: B ____ C ____ D ____

INJURIES AND ILLNESSES

Yes _____ No _____

Describe: _____

MAJOR ACTIVITIES CONDUCTED THIS WEEK:

(drum handling, sampling, excavation, abatement/T&D, etc.)

SIGNIFICANT EVENTS THIS WEEK:

(regulatory visits, equipment malfunctions, process start-up or shutdown):

FUTURE ISSUES:

(schedule, manpower allocation, monitoring equipment, other resources needed)

SITE AUDIT/INSPECTIONS CONDUCTED

Yes _____ No _____

(describe outstanding findings and attach results)

HAZARDOUS ACTIVITIES

Hot Work.....	Yes _____	No _____	Dates: _____
Lockout/Tagout	Yes _____	No _____	Dates: _____
Confined Space Entry	Yes _____	No _____	Dates: _____
Soils Analysis Classification	Yes _____	No _____	Dates: _____
Excavation Daily Check List.....	Yes _____	No _____	Dates: _____
Crane On-Site	Yes _____	No _____	Dates: _____
Critical Lift Plan Performed	Yes _____	No _____	Dates: _____

AIR MONITORING:							
Real Time							
Major Activity	Location(s)	Worker Occupation	FID/PID Range	CGI/O2 Range	PDM Range	Other	
PERSONAL AIR MONITORING							
Analyte	Activity Monitored	Occupation	Location	Result	Type of Sample*		
SUBCONTRACTORS ON SITE							
Company Name	Task or Function	Return to Site Next Week (Y/N)					
Environmental Leader - Signature		Date					

CHANGE REQUEST FORM

PROJECT: _____

CHANGE NUMBER: _____

PROJECT LOCATION: _____

DESCRIPTION OF CHANGE: _____

REASON FOR CHANGE: _____

RECOMMENDED DISPOSITION: _____

EL: _____ **Signature** _____ **Date** _____

SAFETY MANAGER:

_____	_____
Signature	Date

DISTRIBUTION:

- Safety Manager
- Project Manager
- Quality Assurance Representative
- Environmental Leader

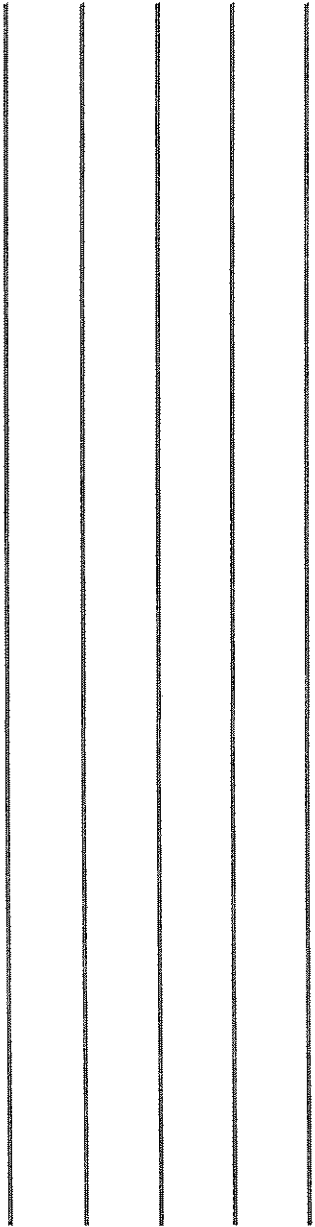
GENERIC EHS PLAN CHANGE

Change Number: _____ Date Effective: _____

Pen and Ink changes to be made in the Generic EHS Plan to alert the reader of this change:

Reason for the change to be incorporated into the Generic EHS Plan:

TEXT OF CHANGE TO BE INCORPORATED:



CHANGE RECORDS

Record of Changes:

Initial for attaching any Changes to this Generic EHS Plan. Enter the Change Number and Date Issued. File the completed field changes to this Generic EHS Plan at the end as attachments. Make PEN and INK changes in the text to alert the reader to the changes that are required in the Change.

CHANGE NUMBER	DATE ENTERED	SYNOPSIS OF CHANGE	INITIAL

E 6.1 - PERSONAL PROTECTIVE EQUIPMENT (PPE) SELECTION

ACTIVITY: _____

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR

EL _____

APPENDIX B

TABLE 2-1, CHEMICAL DATA

TABLE 2-1
Chemical Data

COMPOUND	CAS#	ACGIH TLV	OSHA PEL	ROUTE OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Benzene	71-43-2	0.5 ppm, (Skin)(Ca.) 2.5 ppm STEL	1.0 ppm, (Skin) 5 ppm STEL	Inhalation Ingestion Absorption Skin Contact	Irritates eyes, skin, nose, resp. syst.; giddiness, headache, nausea, staggered gait, fatigue, lassitude; dermatitis	Eyes, skin, blood, CNS, bone marrow, respiratory system	Liquid with an aromatic odor VP= 75 mm IP= 9.24eV
PAHs as Coal tar pitch volatiles (CTPV)	65996-93-2	0.2 mg/m ³ (Ca.)	0.2 mg/m ³	Inhalation Skin contact	Irritant to eyes, swelling, acne contact dermatitis,	Resp. System, CNS, liver, kidneys, skin, bladder	Colorless/ pale green, solid, faint aromatic odor
Cyanide	74-90-8 592-01-8 151-50-8 143-33-9	5 mg/m ³ 4.7 ppm (skin) (C)	10 ppm (skin)	Ingestion, Inhalation, Skin contact	Irritates eyes, skin, nose, throat, dizziness, nausea	Eyes, skin, resp. sys, CNS, skeleton, kidneys	Variable
Ethyl benzene	100-41-4	100 ppm	100 ppm	Inhalation Skin Contact Ingestion	Irritates eyes, skin, mucous membranes; headache; dermatitis; narcosis, coma.	Eyes, skin, resp. system, CNS	VP= 7 mm, aromatic odor, IP= 8.76 eV
Toluene	108-88-3	50 ppm (skin)	200 ppm 300 ppm (C) 500 ppm (10 min max peak)	Inhalation Absorption Ingestion Skin Contact	Irritates eyes and nose, fatigue, weakness, confusion, euphoria, dizziness; headache, dilated pupils, lacrimation, nervousness, muscular fatigue, insomnia; dermatitis,	Liver, eyes kidneys, resp syst. skin, CNS	Colorless liquid with a sweet, pungent, benzene like odor. VP= 21 mm IP= 8.82eV
Xylene	1330-20-7	100 ppm, 150 ppm (STEL)	100 ppm	Inhalation Absorption Ingestion Skin Contact	Irritates eyes, nose, throat, and skin; dizziness, drowsiness, staggered gait, vomiting, abdominal pain, dermatitis	Eyes, skin, resp. system, GI tract, CNS, blood, liver, kidneys	Colorless liquid with an aromatic odor VP = 79 mm IP= 8.56 eV

Abbreviations

C = ceiling limit, not to be exceeded
Ca. = Carcinogen (Cancer Causing)
CNS = Central Nervous System
CVS= Cardiovascular System
eV = electron volt
FP = Flash point
IP = Ionization Potential

mm = millimeter
NE = not established
ppm = parts per million
Skin = significant route of exposure
STEL = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure approximately 68° F in mm Hg (mercury)

APPENDIX C

MATERIAL SAFETY DATA SHEETS

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Benzene, 99%

Catalog Numbers:

AC296880000, AC296880010, AC296880025, AC296880250, AC610231000

Synonyms:

Benzol; Benzole; Benzolene; Carbon oil; Coal naphtha;

Cyclohexatriene; Mineral naphtha; Phenyl hydride; Pyrobenzol;

Pyrobenzole

Company Identification (Europe): Acros Organics BVBA

Janssen Pharmaceuticaaan 3a

2440 Geel, Belgium

Company Identification (USA): Acros Organics

One Reagent Lane

Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01

For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

+-----+-----+-----+-----+			
CAS#	Chemical Name	%	EINECS#
+-----+-----+-----+-----+			
71-43-2	Benzene	99.0	200-753-7
+-----+-----+-----+-----+			

Hazard Symbols: T F

Risk Phrases: 11 45 48/23/24/25

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: colorless liquid. Flash Point: -11 deg C.

Danger! Extremely flammable liquid. Aspiration hazard if swallowed.

Can enter lungs and cause damage. May cause central nervous system effects. Causes eye and skin irritation. Causes digestive and respiratory tract irritation. May cause reproductive and fetal effects. Cancer hazard. May cause blood abnormalities. Harmful or fatal if swallowed.

Target Organs: Blood, central nervous system, eyes, bone marrow, immune system.

Potential Health Effects

Eye: Causes severe eye irritation. May cause slight transient injury.

Skin: Causes moderate skin irritation. May be absorbed through the skin in harmful amounts. Direct contact with the liquid may cause erythema (redness) and vesiculation (blistering). Prolonged or repeated contact has been associated with the development of a dry scaly dermatitis or with secondary infections.

Ingestion: Aspiration hazard. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure.

May cause effects similar to those for inhalation exposure.

Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.

Inhalation: Causes respiratory tract irritation. May cause adverse central nervous system effects including headache, convulsions, and possible death. May cause drowsiness, unconsciousness, and central nervous system depression. Central nervous system effects may include confusion, ataxia, vertigo, tinnitus, weakness, disorientation, lethargy, drowsiness, and finally coma. Exposure may lead to irreversible bone marrow injury. Exposure may lead to aplastic anemia. May be absorbed through the lungs.

Chronic: Possible cancer hazard based on tests with laboratory animals. Prolonged or repeated exposure may cause adverse reproductive effects. May cause bone marrow abnormalities with damage to blood forming tissues. May cause anemia and other blood cell abnormalities. Chronic exposure has been associated with an increased incidence of leukemia and multiple myelomas. Immunodepressive effects have been reported. Animal studies have reported fetotoxicity (growth retardation) and teratogenicity (exencephaly, angulated ribs, dilated brain ventricles).

****** SECTION 4 - FIRST AID MEASURES ******

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:

Get medical aid immediately. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:

Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Possible aspiration hazard. Get medical aid immediately.

Inhalation:

Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.

****** SECTION 5 - FIRE FIGHTING MEASURES ******

General Information:

Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Vapors can travel to a source of ignition and flash back. Extremely flammable. Material will readily ignite at room temperature. Use water spray to keep fire-exposed containers cool. Containers may explode in the heat of a fire. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Vapors may form an explosive mixture with air.

Extinguishing Media:

Use water spray to cool fire-exposed containers. Water may be ineffective. Do NOT use straight streams of water. For large fires, use water spray, fog or regular foam. For small fires, use dry chemical, carbon dioxide, water spray or regular foam. Cool containers with flooding quantities of water until well after fire is out.

Autoignition Temperature: 561 deg C (1,041.80 deg F)

Flash Point: -11 deg C (12.20 deg F)

Explosion Limits, lower: 1.3 vol %

Explosion Limits, upper: 7.1 vol %

NFPA Rating: (estimated) Health: 2; Flammability: 3; Reactivity: 0

****** SECTION 6 - ACCIDENTAL RELEASE MEASURES ******

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Use water spray to dilute spill to a non-flammable mixture. Avoid runoff into storm sewers and ditches which lead to waterways. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as saw dust.

****** SECTION 7 - HANDLING and STORAGE ******

Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Do not ingest or inhale. Use only in a chemical fume hood. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage:

Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

****** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ******

Engineering Controls:

Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Chemical Name	NIOSH	
Benzene	0.5 ppm; ACGIH 0.5 ppm; 2.5 ppm STEL; skin - potential for cutaneous absorption NIOSH 0.1 ppm NIOSH Potential Occupational Carcinogen - see Appendix A segments OSHA - Final PELs (apply only to exempt industry)10 ppm; C 25 ppm; 1 ppm TWA;	0.1 ppm TWA; 10 ppm TWA

OSHA Vacated PELs:

Benzene:

10 ppm TWA (unless specified in 1910.1028); 50 ppm STEL (10 min)
(unless specified in 1910.1028); C 25 ppm (unless specified in
1910.1028)

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical
safety goggles as described by OSHA's eye and face
protection regulations in 29 CFR 1910.133 or European
Standard EN166.

Skin:

Wear appropriate protective gloves to prevent skin
exposure.

Clothing:

Wear appropriate protective clothing to prevent skin
exposure.

Respirators:

A respiratory protection program that meets OSHA's 29
CFR :1910.134 and ANSI Z88.2 requirements or European
Standard EN 149 must be followed whenever workplace
conditions warrant a respirator's use.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Liquid

Appearance: colorless liquid

Odor: sweetish odor - aromatic odor

pH: Not available.

Vapor Pressure: 74.3 mm Hg @ 20 deg C

Vapor Density: 2.7 (Air=1)

Evaporation Rate: 2.8 (Ether=1)

Viscosity: 0.647mPa @ 20 deg C

Boiling Point: 80 deg C

Freezing/Melting Point: 6 deg C

Decomposition Temperature: Not available.

Solubility in water: Slightly soluble.

Specific Gravity/Density: 0.874

Molecular Formula: C₆H₆

Molecular Weight: 78.042

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials, ignition sources, excess heat.

Incompatibilities with Other Materials:

Chlorine, oxygen, ozone, permanganates, sulfuric acid, peroxides, perchlorates, nitrating agents, nitric acid, chromic acid anhydride, chromium trioxide, iodine pentafluoride, iodine heptafluoride, dioxygenyl tetrafluoroborate, dioxygen difluoride + hydrogen fluoride, sodium peroxide, uranium hexafluoride, bromine pentafluoride, chlorine trifluoride, nitryl perchlorate, arsenic pentafluoride, potassium methoxide, permanganic acid, peroxodisulfuric acid, liquid oxygen, peroxomonosulfuric acid, metal perchlorates, strong oxidizing agents.

Hazardous Decomposition Products:

Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.

Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

CAS# 71-43-2: CY1400000

LD50/LC50:

CAS# 71-43-2: Dermal, guinea pig: LD50 = >9400 uL/kg; Draize test, rabbit, eye: 88 mg Moderate; Draize test, rabbit, eye: 2 mg/24H Severe; Draize test, rabbit, skin: 20 mg/24H Moderate; Inhalation, mouse: LC50 = 9980 ppm; Inhalation, rat: LC50 = 10000 ppm/7H; Oral, mouse: LD50 = 4700 mg/kg; Oral, rat: LD50 = 930 mg/kg; Skin, rabbit: LD50 = >9400 uL/kg.

Carcinogenicity:

Benzene -

ACGIH: A1 - Confirmed Human Carcinogen

California: carcinogen; initial date 2/27/87

NIOSH: occupational carcinogen

NTP: Known carcinogen

OSHA: Select carcinogen

IARC: Group 1 carcinogen

Epidemiology:

IARC has concluded that epidemiological studies have established the relationship between benzene exposure and the development of acute myelogenous leukemia, and that there is sufficient evidence that benzene is carcinogenic to humans. Animal studies have demonstrated fetotoxicity (growth retardation) and teratogenicity (exencephaly, angulated ribs, dilated brain ventricles).

Teratogenicity:

Inhalation, rat: TCLO = 50 ppm/24H (female 7-14 day(s) after conception) Effects on Embryo or Fetus - extra-embryonic structures (e.g., placenta, umbilical cord) and Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus);

Inhalation, mouse: TCLO = 5 ppm (female 6-15 day(s) after conception) Effects on Embryo or Fetus - cytological changes (including somatic cell genetic material) and Specific Developmental Abnormalities - blood and lymphatic systems (including spleen and marrow).

Reproductive Effects:

Inhalation, rat: TCLO = 670 mg/m³/24H (female 15 day(s) pre-mating

and female 1-22 day(s) after conception) female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated).; Oral, mouse: TDLo = 12 gm/kg (female 6-15 day(s) after conception) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).

Neurotoxicity:

No information available.

Mutagenicity:

DNA Inhibition: Human, Leukocyte = 2200 umol/L.; DNA Inhibition: Human, HeLa cell = 2200 umol/L.; Mutation Test Systems - not otherwise specified: Human, Lymphocyte = 5 umol/L.; Cytogenetic Analysis: Inhalation, Human = 125 ppm/1Y.; Cytogenetic Analysis: Human, Leukocyte = 1 mmol/L/72H.; Cytogenetic Analysis: Human, Lymphocyte = 1 mg/L.

Other Studies:

Standard Draize Test(Skin, rabbit) = 20 mg/24H (Moderate) Standard Draize Test: Administration into the eye (rabbit) = 2 mg/24H (Severe).

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:

If benzene is released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. If benzene is released to water, it will be subject to rapid volatilization. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.

US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: CAS# 71-43-2: waste number U019; (Ignitable waste, Toxic waste).

****** SECTION 14 - TRANSPORT INFORMATION ******

US DOT

Shipping Name: RQ, BENZENE

Hazard Class: 3

UN Number: UN1114

Packing Group: II

Canadian TDG

Shipping Name: BENZENE

Hazard Class: 3(9.2)

UN Number: UN1114

****** SECTION 15 - REGULATORY INFORMATION ******

US FEDERAL

TSCA

CAS# 71-43-2 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

CAS# 71-43-2: final RQ = 10 pounds (4.54 kg); receives an adjustable R

Section 302 (TPQ)

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 71-43-2: acute, chronic, flammable.

Section 313

This material contains Benzene (CAS# 71-43-2, 99.0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

Clean Air Act:

CAS# 71-43-2 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

CAS# 71-43-2 is listed as a Hazardous Substance under the CWA.

CAS# 71-43-2 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 71-43-2 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

Benzene can be found on the following state right to know lists:

California, New Jersey, Florida, Pennsylvania, Minnesota,

Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Benzene, a chemical known to the state of California to cause cancer.

WARNING: This product contains Benzene, a chemical known to the state of California to cause birth defects or other reproductive harm.

California No Significant Risk Level:

CAS# 71-43-2: no significant risk level = 7 ug/day

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T F

Risk Phrases:

R 11 Highly flammable.

R 45 May cause cancer.

R 48/23/24/25 Toxic : danger of serious damage to health by prolonged exposure through inhalation, contact with skin and if swallowed.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 71-43-2: 3

United Kingdom Occupational Exposure Limits

****** SECTION 16 - ADDITIONAL INFORMATION ******

MSDS Creation Date: 6/11/1999 Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way will the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

TECHNOLOGY CHEMICAL INC

-- COAL TAR CREOSOTE

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MSDS Safety Information

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FSC: 6840
NIIN: 00-286-0446
MSDS Date: 02/04/1993
MSDS Num: BPWXF
Product ID: COAL TAR CREOSOTE
MFN: 01
Responsible Party
Cage: 2U663
Name: TECHNOLOGY CHEMICAL INC
Address: 3718 GRAND AVE
Box: 13268
City: OAKLAND CA 94661
Info Phone Number: 510-339-3066
Emergency Phone Number: 510-339-3066
Preparer's Name: DGSC-SSH 804-279-4371
Review Ind: Y
Published: Y

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Preparer Co. when other than Responsible Party Co.

=====

Cage: 2U663
Name: TECHNOLOGY CHEMICAL INC
Address: 3718 GRAND AVE
Box: 13268
City: OAKLAND CA 94661

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Contractor Summary

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Cage: 2U663
Name: TECHNOLOGY CHEMICAL INC
Address: 3718 GRAND AVE
Box: 13268
City: OAKLAND CA 94661
Phone: 510-339-3066

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Item Description Information

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Item Manager: S9G
Unit of Issue: DR
Quantitative Expression: 00000000055GL
UI Container Qty: 1
Type of Container: DRUM

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Ingredients

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Cas: 8001-58-9
RTECS #: GF8615000
Name: CREOSOTE (SARA III)
% Wt: UNKNOWN
Other REC Limits: 0.2 MG/M3 COAL TAR
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Cas: 95-13-6

RTECS #: NK8225000
Name: INDENE
% Wt: <10
Other REC Limits: NONE SPECIFIED
OSHA PEL: 10 PPM
ACGIH TLV: 10 PPM; 9192

Cas: 91-20-3
RTECS #: QJ0525000
Name: NAPHTHALENE (SARA III)
% Wt: <15
Other REC Limits: NONE SPECIFIED
OSHA PEL: 10 PPM/15 STEL
ACGIH TLV: 10 PPM/15 STEL; 9192
EPA Rpt Qty: 100 LBS
DOT Rpt Qty: 100 LBS

Cas: 92-52-4
RTECS #: DU8050000
Name: DIPHENYL (BIPHENYL) (SARA III)
% Wt: <5
Other REC Limits: NONE SPECIFIED
OSHA PEL: 0.2 PPM
ACGIH TLV: 0.2 PPM; 9192
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Cas: 71-43-2
RTECS #: CY1400000
Name: BENZENE (SARA III)
% Wt: <1
Other REC Limits: NONE SPECIFIED
OSHA PEL: 1PPM/5STEL;1910.1028
ACGIH TLV: 10 PPM; A2; 9192
EPA Rpt Qty: 10 LBS
DOT Rpt Qty: 10 LBS

Name: ALKYL NAPHTHALENE
% Wt: <10
Other REC Limits: NONE SPECIFIED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

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Health Hazards Data

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LD50 LC50 Mixture: LD50 (ORAL RAT) IS 1,700 MG/KG
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: NO
Carcinogenicity Inds - NTP: YES
IARC: YES
OSHA: YES
Effects of Exposure: ACUTE-EYE:MAY CAUSE MODERATE IRRITATION. SKIN: CAN RESULT
IN SEVERE IRRITATION WHICH WHEN ACCENTUATED BY SUNLIGHT MAY RESULT IN
PHOTOTOXIC SKIN REACTION. INHALATION: IRRITATION, CNS EFFECTS, SUCH AS HEADAC
HE, DIZZINESS, COMA AND POSSIBLE DEATH. INGESTION: IRRITATION, NAUSEA, VOMITING
& ABDOMINAL PAIN. CHRONIC-MAY CAUSE CANCER.
Explanation Of Carcinogenicity: BENZENE. IARC LISTS CREOSOTE AS A POSSIBLE
CARCINOGENIC AGENT TO HUMAN.
Signs And Symptoms Of Overexposure: MAY BE FATAL IF SWALLOWED., NAUSEA,

VOMITING. IRRITATION OF RESPIRATORY TRACT, COUGHING AND CHOKING. EYE AND SKIN

IRRITATION.

Medical Cond Aggravated By Exposure: PERSONS WITH PRE-EXISTING DISEASE INVOLVING THE SKIN OR BLOOD-FORMING ORGANS MAY BE AT A GREATER RISK OF DEVELOPING ADVERSE HEALTH EFFECTS WHEN EXPOSED TO THIS MATERIAL.

First Aid: SEEK MEDICAL AID.EYE:FLUSH WITH WATER FOR 15 MINUTES.SKIN:WIPE MATERIAL OFF.WASH THOROUGHLY WITH SOAP & WATER/WATERLESS HAND CLEANER.INHALATION:REMOVE TO FRESH AIR.GIVE CPR/OXYGEN IF NEEDED. INGESTION :GIVE 1-2 GLASSES OF WATER/MILK IF CONSCIOUS.INDUCE VOMITING USING IPECAC SYRUP.THEN,GIVE A SLURRY OF 100 G OF ACTIVATED CHARCOAL IN 8 OZ OF WATER.

Handling and Disposal

Spill Release Procedures: STOP LEAK IF NO RISK INVOLVED. STAY UPWIND. SOLIDIFIED SPILL:SHOVEL INTO DRY CONTAINERS AND COVER. FLUSH AREA WITH WATER.SMALL WET SPILL:TAKE UP WITH SAND. FLUSH AREA WITH WATER. DIKE LARGE SPILLS FOR LATER DISPOSAL.CONTAIN RUNOFF FROM FIRE CONTROL.

Waste Disposal Methods: CONSULT LOCAL AUTHORITIES;DISPOSAL MUST BE IN ACCORDANCE WITH LOCAL,STATE AND FEDERAL REGULATIONS. THIS PRODUCT RELEASED INTO THE ENVIRONMENT MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER (800-424 -8802). WHEN SPILLED,REPORTABLE QUANTITY IS 1 LB.

Handling And Storage Precautions: STORE IN COOL, DRY AND WELL VENTILATED AREA. KEEP CONTAINER CLOSED WHEN NOT IN USE.

Other Precautions: AVOID PROLONGED/REPEATED BREATHING OF VAPORS,MISTS/ FUMES.AVOID PROLONGED/REPEATED CONTACT WITH SKIN/EYES.APPLICATION OF CERTAIN PROTECTIVE CREAMS (SUN SCREENS FOR COAL TAR PRODUCTS) BEFORE WORKING/SE

VERAL

TIMES DURING WORK MAY BE BENEFICIA

Fire and Explosion Hazard Information

Flash Point Method: CC

Flash Point Text: >200F,>93C

Extinguishing Media: USE WATER FOG, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL. WATER OR FOAM MAY CAUSE FROTHING, IF MOLTEN.

Fire Fighting Procedures: WEAR COMPLETE FIRE SERVICE PROTECTIVE EQUIPMENT,INCLUDING FULL-FACE MSHA/NIOSH APPROVED SELF-CONTAINED BREATHING APPARATUS.USE WATER TO COOL CONTAINERS BY FIRE.

Unusual Fire/Explosion Hazard: TOXIC VAPORS/DECOMPOSITION PRODUCTS MAY BE RELEASED FORMING FLAMMABLE/EXPLOSIVE MIXTURES IN AIR. CLOSED CONTAINERS MAY EXPLODE WHEN EXPOSED TO EXTREME HEAT.

Control Measures

Respiratory Protection: NONE NORMALLY REQUIRED.IF EXPOSURES ARE ABOVE TLV(PEL),USE NIOSH APPROVED UNITS AS PER CURRENT 29 CFR 1910.134 AND MANUFACTURERS' "INSTRUCTIONS" AND "WARNINGS". COMBINATION FILTER/ORGANIC VAPOR CARTRIDGES OR CANISTER MAY BE USED.

Ventilation: PROVIDE SUFFICIENT GENERAL/LOCAL EXHAUST VENTILATION TO CONTROL INHALATION EXPOSURE < EXPOSURE LIMITS.

Protective Gloves: IMPERVIOUS

Eye Protection: SAFETY GLASSES/GOGGLES

Other Protective Equipment: IMPERVIOUS PROTECTIVE GARMENTS SUCH AS HEAD/ NECK COVER,APRONS,JACKETS,PANTS,BOOTS,ETC.EYE-WASH FACILITIES,SAFETY SHOWER

Work Hygienic Practices: AVOID CONTACT WITH EYES AND SKIN;DO NOT BREATHE VAPORS/MIST.WASH THOROUGHLY AFTER EACH USE.

Supplemental Safety and Health: MSDS IS NOT AVAILABLE FROM MFR. INFORMATION PRESENTED HEREIN IS ACCURATE AND RELIABLE TO THE BEST OF OUR KNOWLEDGE AND BELIEF BUT IS NOT GUARANTEED TO BE SO. IT IS THE USER'S RESPONSIBILITY TO TAKE ALL SAFETY PRECAUTIONS AS MAY BE NECESSARY. WE HEREBY DISCLAIM ALL

LIABILITY WITH RESPECT TO IT'S USE.

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Physical/Chemical Properties

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HCC: T6
B.P. Text: >355F,>179C
M.P/F.P Text: UNKNOWN
Decomp Text: UNKNOWN
Vapor Pres: 1 @ 30C
Vapor Density: >1
Spec Gravity: 1.050
Evaporation Rate & Reference: SLOW (N-BUTYL ACETATE=1)
Solubility in Water: SLIGHT
Appearance and Odor: BROWN TO BLACK LIQUID WITH CREOSOTE OR TARRY ODOR
Corrosion Rate: UNKNOWN

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Reactivity Data

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Stability Indicator: YES
Stability Condition To Avoid: HIGH TEMPERATURES AND OPEN FLAMES
Materials To Avoid: OXIDIZING AGENTS
Hazardous Decomposition Products: OXIDES OF CARBON, SUFUR.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NONE

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Toxicological Information

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Ecological Information

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MSDS Transport Information

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Regulatory Information

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Other Information

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Transportation Information

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Responsible Party Cage: 2U663
Trans ID NO: 66557
Product ID: COAL TAR CREOSOTE
MSDS Prepared Date: 02/04/1993
Review Date: 11/17/1999
MFN: 1
Tech Entry NOS Shipping Nm: CONTAINS CREOSOTE AND INDENE AND NAPHTHALENE
Net Unit Weight: 481 LBS
Multiple KIT Number: 0
Review IND: Y
Unit Of Issue: DR
Container QTY: 1
Type Of Container: DRUM
Additional Data: NOTE: THE MAXIMUM ALLOWED BY PASSENGER/CARGO AIR: 5L / 60L.

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Detail DOT Information

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DOT PSN Code: QKN
Symbols: G

DOT Proper Shipping Name: TOXIC LIQUIDS, ORGANIC, N.O.S.
Hazard Class: 6.1
UN ID Num: UN2810
DOT Packaging Group: II
Label: POISON
Special Provision: B110,T14
Packaging Exception: NONE
Non Bulk Pack: 202
Bulk Pack: 243
Max Qty Pass: 5 L
Max Qty Cargo: 60 L
Vessel Stow Req: B
Water/Ship/Other Req: 40

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Detail IMO Information

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IMO PSN Code: OTX
IMO Proper Shipping Name: TOXIC LIQUID, ORGANIC, N.O.S. o
IMDG Page Number: 6270-1
UN Number: 2810
UN Hazard Class: 6.1
IMO Packaging Group: I/II/III
Subsidiary Risk Label: -
EMS Number: 6.1-02
MED First Aid Guide NUM: T

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Detail IATA Information

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IATA PSN Code: YIE
IATA UN ID Num: 2810
IATA Proper Shipping Name: TOXIC LIQUID, ORGANIC, N.O.S. *
IATA UN Class: 6.1
IATA Label: TOXIC
UN Packing Group: II
Packing Note Passenger: 609
Max Quant Pass: 5L
Max Quant Cargo: 60L
Packaging Note Cargo: 611
Exceptions: A4

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Detail AFI Information

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AFI PSN Code: YGF
AFI Symbols: *
AFI Proper Shipping Name: TOXIC LIQUID, ORGANIC, N.O.S.
AFI Hazard Class: 6.1
AFI UN ID NUM: UN2810
AFI Packing Group: II
Special Provisions: P4
Back Pack Reference: A10.5

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HAZCOM Label

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Product ID: LABEL COVERED UNDER EPA REGS - HAZCOM LABEL NOT AUTHORIZED

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Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense

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SODIUM CYANIDE

1. Product Identification

Synonyms: Hydrocyanic acid, sodium salt; Cyanogran

CAS No.: 143-33-9

Molecular Weight: 49.01

Chemical Formula: NaCN

Product Codes:

J.T. Baker: 3662, 3663

Mallinckrodt: 7616

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent
Hazardous		
-----	-----	-----

Sodium Cyanide	143-33-9	90 - 100%
Yes		

3. Hazards Identification

Emergency Overview

DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CONTACT WITH ACIDS LIBERATES POISONOUS GAS. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. AFFECTS BLOOD, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM AND THYROID.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe (Life)

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

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Potential Health Effects

In most cases, cyanide poisoning causes a deceptively healthy pink to red skin color. However, if a physical injury or lack of oxygen is involved, the skin color may be bluish. Reddening of the eyes and pupil dilation are symptoms of cyanide poisoning. Cyanosis (blue discoloration of the skin) tends to be associated with severe cyanide poisonings.

Inhalation:

Corrosive to the respiratory tract. The substance inhibits cellular respiration and may cause blood, central nervous system, and thyroid changes. May cause headache, weakness, dizziness, labored breathing nausea and vomiting, which can be followed by weak and irregular heart beat, unconsciousness, convulsions, coma and death.

Ingestion:

Highly Toxic! Corrosive to the gastro-intestinal tract with burning in the mouth and esophagus, and abdominal pain. Larger doses may produce sudden loss of consciousness and prompt death from respiratory arrest. Smaller but still lethal doses may prolong the illness for one or more hours. Bitter almonds odor may be noted on the breath or vomitus. Other symptoms may be similar to those noted for inhalation exposure.

Skin Contact:

Corrosive. May cause severe pain and skin burns. Solutions are corrosive to the skin and eyes, and may cause deep ulcers which heal slowly. May be absorbed through the skin, with symptoms similar to those noted for inhalation.

Eye Contact:

Corrosive. Symptoms may include redness, pain, blurred vision, and eye damage.

Chronic Exposure:

Prolonged or repeated skin exposure may cause a "cyanide" rash and nasal sores.

Aggravation of Pre-existing Conditions:

Workers using cyanides should have a preplacement and periodic medical exam. Those with history of central nervous system, thyroid, skin, heart or lung diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

IN CASE OF CYANIDE POISONING, start first aid treatment immediately, then get medical attention. A cyanide antidote kit (amyl nitrite, sodium nitrite and sodium thiosulfate) should be available in any cyanide work area. Actions to be taken in case of cyanide poisoning should be planned and practiced before beginning work with cyanides. Oxygen and amyl nitrite can be given by a first responder before medical help arrives. Allow victim to inhale amyl nitrite for 15-30 seconds per minute until sodium nitrite and sodium thiosulfate can be administered intravenously (see Note to Physician). A new amyl nitrite ampule should be used every 3 minutes. If conscious but symptoms (nausea, difficult breathing, dizziness, etc.) are evident, give oxygen. If consciousness is impaired

(non-responsiveness, slurred speech, confusion, drowsiness) or the patient is unconscious but breathing, give oxygen and amyl nitrite by means of a respirator. If not breathing, give oxygen and amyl nitrite immediately by means of a positive pressure respirator (artificial respiration).

Inhalation:

If inhaled, remove to fresh air. Administer antidote kit and oxygen per pre-planned instructions if symptoms occur. Keep patient warm and at rest. Do not give mouth to mouth resuscitation.

Ingestion:

If ingested, antidote kit and oxygen should be administered per above. If the patient is conscious, immediately give the patient activated charcoal slurry. Never give anything by mouth to an unconscious person. Do not induce vomiting as it could interfere with resuscitator use.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse. Administer antidote kit and oxygen per preplanned instructions if symptoms occur.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

If patient does not respond to amyl nitrite, inject intravenously with 10mL of a 3% solution of sodium nitrite at a rate of not more than 2.5 to 5 mL per minute. Once nitrite administration is complete, follow directly with 50 mL of a 25% solution of sodium thiosulfate at the same rate by the same route. Give victim oxygen and keep under observation. If exposure was severe, watch victim for 24-48 hours. If signs of cyanide poisoning persist or reappear, repeat nitrite and thiosulfate injections 1 hour later in 1/2 the original doses. Cyanocobalamin (B12), 1 mg intramuscularly, may speed recovery. Moderate cyanide exposures need be treated only by supportive measures such as bed rest and oxygen.

5. Fire Fighting Measures

Fire:

Not combustible, but upon decomposition or contact with acids, this material releases highly flammable and toxic hydrogen cyanide gas.

Explosion:

Not considered an explosion hazard, but upon heating with chlorates or nitrites to 450C (842F) may cause an explosion. Violent explosion occurs if melted with nitrite salt. Sealed containers may rupture when heated.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do Not use carbon dioxide.

Carbon dioxide can react with this material in the presence of moisture to produce hydrogen cyanide. Water spray may be used to keep fire exposed containers cool. Reacts slowly with water to form hydrogen cyanide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Spills: Ventilate area of leak or spill. Allow only qualified personnel to handle spill. Clean-up personnel require protective clothing and respiratory protection from vapors. Collect material and place in a closed container for recovery or disposal. Do not flush to sewer! Decontaminate liquid or solid residues in spill area with sodium or calcium hypochlorite solution.

US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Separate from incompatibles. Workers must carefully follow good hygienic practices, including no eating, drinking, or smoking in workplace. Proper use and maintenance of protective equipment is essential. Workers using cyanide need preplacement and annual medical exams. Special training should be given to workers using cyanide. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store near combustibles or flammables because subsequent fire fighting with water could lead to cyanide solution runoff. Do not store under sprinkler systems. All persons with the potential for cyanide poisoning should be trained to provide immediate First Aid using oxygen and amyl nitrite. A cyanide antidote kit (amyl nitrite, sodium nitrite, and sodium thiosulfate) should be readily available in cyanide workplaces. The antidotes should be checked annually to ensure they are still within their shelf-lives. Identification of community hospital resources and emergency medical squads in order to equip and train them on handling cyanide emergencies is essential.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

5 mg/m³ skin (TWA) (as CN)

-ACGIH Threshold Limit Value (TLV):

5 mg/m³ (STEL) Ceiling, skin, as CN

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White deliquescent granular solid.

Odor:

Almond odor. Bitter almonds.

Solubility:

48 g/100 cc @ 10C (50F)

Specific Gravity:

1.60 @ 25C/4C

pH:

Aqueous solutions are strongly alkaline.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1496C (2725F)

Melting Point:

564C (1047F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

1 @ 817C (1503F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Very stable when dry. Moisture will cause slow decomposition, releasing poisonous hydrogen cyanide gas.

Hazardous Decomposition Products:

- Emits toxic fumes of cyanide and oxides of nitrogen when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Acid, nitrates, nitrites, chlorates, fluorine, magnesium, and strong oxidizers. Reacts with acids to liberate toxic and flammable hydrogen cyanide gas. Water or weak alkaline solutions can produce dangerous amounts of hydrogen cyanide in confined areas. Reacts with carbon dioxide in air to form hydrogen cyanide gas.

Conditions to Avoid:

Heat, moisture, incompatibles.

11. Toxicological Information

Oral rat LD50: 6440 ug/kg. Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sodium Cyanide (143-33-9)	No	No	None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

This material is expected to be very toxic to aquatic life. This material is expected to be very toxic to terrestrial life.

13. Disposal Considerations

Cyanides must be oxidized to harmless waste before disposal. An alkaline solution (pH about 10) is treated with chlorine or commercial bleach in excess to decompose cyanide. When cyanide-free, it can be neutralized. Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, SODIUM CYANIDE, SOLID

Hazard Class: 6.1

UN/NA: UN1689

Packing Group: I

Information reported for product/size: 12KG

International (Water, I.M.O.)

Proper Shipping Name: SODIUM CYANIDE, SOLID

Hazard Class: 6.1

UN/NA: UN1689

Packing Group: I

Information reported for product/size: 12KG

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Sodium Cyanide (143-33-9)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Sodium Cyanide (143-33-9)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302-	-SARA 313-		
Catg.	RQ	TPQ	List	Chemical

Sodium Cyanide (143-33-9) 10 100 No Cyanide comp

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8 (d)
Sodium Cyanide (143-33-9)	10	P106	No

Chemical Weapons Convention: Yes TSCA 12(b): Yes CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: 4X

Poison Schedule: S7

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 1

Label Hazard Warning:

DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CONTACT WITH ACIDS LIBERATES POISONOUS GAS. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. AFFECTS BLOOD, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM AND THYROID.

Label Precautions:

Do not breathe dust.

Do not get in eyes, on skin, or on clothing.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

IN ALL CASES, GET MEDICAL ATTENTION IMMEDIATELY. KEEP A CYANIDE ANTIDOTE KIT (amyl nitrite, sodium nitrite and sodium thiosulfate) in area of product use or storage. First-aiders must take precautions to avoid contact with cyanide substance. If ingested, administer antidote kit and oxygen per pre-planned instructions. If the patient is conscious, immediately give the patient activated charcoal slurry. Never give anything by mouth to an unconscious person. Do not induce vomiting as it could interfere with resuscitator use. If inhaled, remove to fresh air. Administer antidote kit and oxygen per pre-planned instructions if symptoms occur. Keep patient warm and at rest. Do not give mouth to mouth resuscitation. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Administer antidote kit and oxygen per preplanned instructions if symptoms occur.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Ethyl Benzene

Catalog Numbers:

O2751 1, O2751-1, O27511

Synonyms:

Ethylbenzol, phenylethane

Company Identification: Fisher Scientific

1 Reagent Lane

Fairlawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

+-----+-----+-----+-----+			
-+			
CAS#	Chemical Name	%	EINECS#
----- ----- ----- -----			
-			
100-41-4	Ethylbenzene	100	202-849-4
+-----+-----+-----+-----+			
-+			

Hazard Symbols: XN F

Risk Phrases: 11 20

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: clear, colorless. Flash Point: 21 deg C.

Warning! Flammable liquid and vapor. Causes skin irritation. Causes eye irritation. May cause central nervous system depression.

Aspiration hazard if swallowed. Can enter lungs and cause damage. May be absorbed through intact skin. Causes digestive and respiratory tract irritation.

Target Organs: Central nervous system.

Potential Health Effects

Eye:

Causes moderate eye irritation. Vapors may cause eye irritation.

Skin:

Causes skin irritation. Prolonged and/or repeated contact may cause irritation and/or dermatitis. May be absorbed through the skin. Contact with the liquid may cause erythema (redness), exfoliation and vesiculation (blistering).

Ingestion:

May cause irritation of the digestive tract. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.

Inhalation:

Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. Vapors may cause dizziness or suffocation.

Chronic:

Chronic inhalation may cause effects similar to those of acute inhalation.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:

Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:

Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Treat symptomatically and

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Contact professional fire-fighters immediately. Cool containers with flooding quantities of water until well after fire is out.

Autoignition Temperature: Not available.

Flash Point: 92 deg C (197.60 deg F)

Explosion Limits, lower: 0.8

Explosion Limits, upper: 6.7

NFPA Rating: (estimated) Health: 3; Flammability: 4; Reactivity: 0

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Use with adequate ventilation. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage:

Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

+-----+-----+-----+-----+-----+				
-+				
Chemical Name	ACGIH	NIOSH	OSHA - Final PELs	
----- ----- ----- ----- -----				
-				
Ethylbenzene	100 ppm;	125 ppm	100 ppm TWA; 435	100 ppm TWA; 435
STEL	mg/m3 TWA 800	mg/m3 TWA		
IDLH (10				
percent lower				
explosive limit)				
+-----+-----+-----+-----+-----+				
-+				

OSHA Vacated PELs:

Ethylbenzene:

100 ppm TWA; 435 mg/m3 TWA; 125 ppm STEL; 545 mg/m3 STEL

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:

Wear appropriate protective gloves and clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Liquid
Appearance: clear, colorless
Odor: aromatic odor
pH: Not available.
Vapor Pressure: 7.1 mm Hg @ 20 C
Vapor Density: 3.7
Evaporation Rate: <1 (butyl acetate=1)
Viscosity: 0.63 mPa s 20 C
Boiling Point: 277 deg F
Freezing/Melting Point: -139 deg F
Decomposition Temperature: Not available.
Solubility in water: Insoluble.
Specific Gravity/Density: 0.9
Molecular Formula: C8H10
Molecular Weight: 106.07

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials:
Oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 100-41-4: DA0700000
LD50/LC50:
CAS# 100-41-4: Draize test, rabbit, eye: 500 mg Severe; Oral, rat:
LD50 = 3500 mg/kg; Skin, rabbit: LD50 = 17800 uL/kg.
Carcinogenicity:
Ethylbenzene -
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen
Epidemiology:
No information available.
Teratogenicity:
No information available.
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:
Mutation in mammalian somatic cells (Rodent,mouse) Lymphocyte = 80
mg/L.
Other Studies:
Standard Draize Test: Administration into the eye (rabbit) = 500 mg
(Severe). Standard Draize Tes (Rabbit, Skin) = 15 mg/L; Mild.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:

Shrimp (mysidoposis bahia), LC50=87.6 mg/L/96hr. Sheepshead minnow LC50=275 mg/L/96hr. Fathead minnow LC50=42.3 mg/L/96hr in hard water & 48.5 mg/L/96hr in softwater.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.

US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

Shipping Name: ETHYLBENZENE

Hazard Class: 3

UN Number: UN1175

Packing Group: II

Canadian TDG

Shipping Name: ETHYL BENZENE

Hazard Class: 3(9.2)

UN Number: UN1175

Other Information: FLASHPOINT 15C

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 100-41-4 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 100-41-4: Effective Date: June 19, 1987; Sunset Date: June 19, 1997

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

CAS# 100-41-4: final RQ = 1000 pounds (454 kg)

Section 302 (TPQ)

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 100-41-4: acute, chronic, flammable.

Section 313

This material contains Ethylbenzene (CAS# 100-41-4, 100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

Clean Air Act:

CAS# 100-41-4 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 100-41-4 is listed as a Hazardous Substance under the CWA.

CAS# 100-41-4 is listed as a Priority Pollutant under the Clean Water

Act.

CAS# 100-41-4 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

Ethylbenzene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN F

Risk Phrases:

R 11 Highly flammable.

R 20 Harmful by inhalation.

Safety Phrases:

S 16 Keep away from sources of ignition - No smoking.

S 24/25 Avoid contact with skin and eyes.

S 29 Do not empty into drains.

WGK (Water Danger/Protection)

CAS# 100-41-4: 1

United Kingdom Occupational Exposure Limits

CAS# 100-41-4: OES-United Kingdom, TWA 100 ppm TWA; 441 mg/m3 TWA

CAS# 100-41-4: OES-United Kingdom, STEL 125 ppm STEL; 552 mg/m3 STEL

Canada

CAS# 100-41-4 is listed on Canada's DSL List.

This product has a WHMIS classification of B2, D2B, D2A.

CAS# 100-41-4 is listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 100-41-4: OEL-AUSTRALIA:TWA 100 ppm (435 mg/m3);STEL 125 ppm (545 mg/m3)

OEL-BELGIUM:TWA 100 ppm (434 mg/m3);STEL 125 ppm (543 mg/m3)

OEL-CZECHOSLOVAKIA:TWA 200 mg/m3;STEL 1000 mg/m3

OEL-DENMARK:TWA 50 ppm (217 mg/m3)

OEL-FINLAND:TWA 100 ppm (435 mg/m3);STEL 150 ppm (655 mg/m3)

OEL-FRANCE:TWA 100 ppm (435 mg/m3)

OEL-GERMANY:TWA 100 ppm (440 mg/m3);Skin

OEL-HUNGARY:TWA 100 mg/m3;STEL 200 mg/m3;Skin

OEL-JAPAN:TWA 100 ppm (430 mg/m3)

OEL-THE NETHERLANDS:TWA 100 ppm (435 mg/m3)

OEL-THE PHILIPPINES:TWA 100 ppm (435 mg/m3)

OEL-POLAND:TWA 100 mg/m3

OEL-RUSSIA:TWA 100 ppm;STEL 50 mg/m3

OEL-SWEDEN:TWA 50 ppm (200 mg/m3);STEL 100 ppm (450 mg/m3)

OEL-SWITZERLAND:TWA 100 ppm (435 mg/m3);STEL 500 ppm

OEL-TURKEY:TWA 100 ppm (435 mg/m3)

OEL-UNITED KINGDOM:TWA 100 ppm (435 mg/m3);STEL 125 ppm

OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV

OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 4/28/1999 Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of

merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

TOSCO**-- GASOLINE MID-GRADE UNLEADED**

MSDS Safety Information

FSC: 9130

MSDS Date: 10/02/1996

MSDS Num: CFLWY

LIIN: 00N079570

Product ID: GASOLINE MID-GRADE UNLEADED

MFN: 01

Responsible Party

Cage: JO521

Name: TOSCO

Address: 72 CUMMINGS POINT RD

City: STAMFORD CT 06901

Info Phone Number: 360-384-1011

Emergency Phone Number: 510-228-1220

Published: Y

Contractor Summary

Cage: JO521

Name: TOSCO

Address: 72 CUMMINGS POINT RD

City: STAMFORD CT 06901

Phone: 360-384-1011

Cage: TXSCX

Name: TOSCO REFINING CO

Address: 2300 CLAYTON RD

City: CONCORD CA 94520

Phone: 800-424-9300 (CHEMTREC)

Ingredients

Cas: 108-88-3

RTECS #: XS5250000

Name: TOLUENE (SARA 313) (CERCLA)

% Wt: 2-8

OSHA PEL: 200 PPM

ACGIH TLV: 50 PPM, S

EPA Rpt Qty: 1000 LBS

DOT Rpt Qty: 1000 LBS

Cas: 71-43-2

RTECS #: CY1400000

Name: BENZENE (SARA 313) (CERCLA)

% Wt: 0-3

OSHA PEL: SEE 1910.1028

ACGIH TLV: 10 PPM, A2

EPA Rpt Qty: 10 LBS

DOT Rpt Qty: 10 LBS

Cas: 95-63-6

RTECS #: DC3325000

Name: BENZENE, 1,2,4-TRIMETHYL-; (1,2,4-TRIMETHYLBENZENE) (SARA 313)

% Wt: 0-2

OSHA PEL: 25 PPM

ACGIH TLV: 25 PPM

Cas: 100-41-4

RTECS #: DA0700000

Name: BENZENE, ETHYL-; (ETHYL BENZENE) (SARA 313)

% Wt: 0-2

OSHA PEL: 100 PPM

ACGIH TLV: 100 PPM/125 STEL

EPA Rpt Qty: 1000 LBS

DOT Rpt Qty: 1000 LBS

Cas: 110-82-7

RTECS #: GU6300000

Name: CYCLOHEXANE (SARA 313) (CERCLA)

% Wt: 0-1

OSHA PEL: 300 PPM

ACGIH TLV: 300 PPM

EPA Rpt Qty: 1000 LBS

DOT Rpt Qty: 1000 LBS

Cas: 64-17-5

RTECS #: KQ6300000

Name: ETHYL ALCOHOL (ETHANOL)

% Wt: 0-11

OSHA PEL: 1000 PPM

ACGIH TLV: 1000 PPM

Cas: 8006-61-9

RTECS #: LX3300000

Name: GASOLINE (CONTAINING INGREDIENTS 1-6; 8-10)

% Wt: 89-100

OSHA PEL: 300 PPM

ACGIH TLV: 300 PPM/500 STEL

Cas: 1634-04-4

RTECS #: KN5250000

Name: ETHER, TERT-BUTYL METHYL-; (METHYL TERT-BUTYL ETHER) (SARA 313) (CERCLA)

OSHA PEL: N/K (FP N)

ACGIH TLV: N/K (FP N)

EPA Rpt Qty: 1 LB

DOT Rpt Qty: 1 LB

Cas: 637-92-3

RTECS #: KN4730200

Name: ETHER, TERT-BUTYL ETHYL; (ETHYL TERT-BUTYL ETHER)

OSHA PEL: N/K (FP N)

ACGIH TLV: N/K (FP N)

Cas: 1330-20-7

RTECS #: ZE2100000

Name: XYLENE (SARA 313) (CERCLA)

% Wt: 5-10

OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM/150 STEL
EPA Rpt Qty: 1000 LBS
DOT Rpt Qty: 1000 LBS

Name: EXPLAN OF CARCIN:OSHA REG:CFR 29 1910.1028. HUMAN:BLOOD. GASOLINE:IARC
MONO, VOL 45, PG 159, 1989:GROUP 2B. ANIMAL:SKIN.

Name: EFTS OF OVEREXP: SECONDARY INFECTION. HIGH PRESS SKIN INJECTIONS ARE
SERIOUS MED EMER. REQUIRE IMMED MED ATTN.

Name: ING 12: EYE: TRANSIENT IRRIT. INHAL: IRRIT. HARMFUL CNS EFTS. EXCITATION,
EUPHORIA, HDCH, DIZZ, DROW, BLURRED

Name: ING 13: VISION, FATG, TREMORS, CONVLS, LOSS OF CONSCIOUSNESS, COMA, RESP
ARREST & DEATH. ANEMIA & IRREG HEART

Name: ING 14: RHYTHM. BEHAVIORAL CHANGES. CHRONIC:ING 1:LONG-TERM CHRONIC
BRONCH, IRRIT, INCRD SPUTUM, TIGHTNESS OF

Name: ING 15: CHEST, WHEEZING, DECRD ENDURANCE, DMG TO KIDNEYS & LIVER. ING
2:AFFECTS HEMATOPOIETIC SYS, BLOOD

Name: ING 16: DISORDERS, ANEMIA & PANCYTOPENIA. ING 5:CHRONIC BRONCH, INCRD
SPUTUM, TIGHT CHEST, WHEEZING, DECRD

Name: ING 17: ENDURANCE. ING 10:DISTURB OF GI TRACT, DMG TO KIDNEYS &
LIVER, EXPT REPRO HAZ & TERATOGEN. TOLUENE

Name: ING 18: APPEARS ON THE NAVY OCCUP CHEM REPRO HAZ LIST. SEEK CONSULT FROM
APPROP HLTH PROFESSIONALS CONCERNING

Name: ING 19: LATEST HAZ LIST INFO & SAFE HNDLG & EXPOS INFO (FP N).
CONTACT NEHC FOR MORE SPECIFIC INFORMATION (FP N).

Name: FIRST AID PROC: SKIN BARRIER IS MOST PROT. IN GEN, THERE IS NO SPECIFIC
TREATMENT FOR HYDROCARBON EXPOS.

Name: ING 21: TREATMENT IS SUPPORTIVE. INHAL EXPOS TO GASOLINE VAP MOST
COMMONLY OCCURS DURING INAPPROP USE OF

Name: ING 22: GASOLINE AS DEGREASER/SOLV. THIS EXPOS MAY BE EXACERBATED BY WORK
IN CONFINED SPACE. GASOLINE COMPONENTS

Name: ING 23: HAVE BOTH IRRIT & ANESTH PROPERTIES. AT HIGH CONCS, IT CAN
ACT AS SIMPLE ASPHY. GEN, INDIVIDUALS ACUTELY

Name: ING 24: EXPOSED TO ANESTH LEVELS OF EXPOS CAN REQUIRE RESUSCITATION &
RESP SUPPORT. CONT NEHC FOR MORE INFO (FP N).

Health Hazards Data

LD50 LC50 Mixture: LD50 (ORAL RAT): 18.75 ML/KG.
Route Of Entry Inds - Inhalation: YES
Skin: YES

Ingestion: YES

Carcinogenicity Inds - NTP: YES

IARC: YES

OSHA: YES

Effects of Exposure: ACUTE:INGS 1 & 10:IRRIT OF LUNGS, THROAT & AIRWAYS. SEV EYE IRRIT. CNS DEPRESS. ING 2:HARMFUL/FATAL. IRRIT TO SKIN & EYE. CNS DEPRESS. ING 3:IRRIT, CNS DEPRESS, BONE MARROW DEPRESS & ANEMIA. ING 4:IRRIT, PULM EDEMA, SENSE OF CONSTRICTION IN CHEST. DMG TO KIDNEYS & LIVER. EXPT TERATOGEN. ING 5:IRRIT. (EFTS OF OVEREXP)

Explanation Of Carcinogenicity: BENZENE: IARC MONO, VOL 7, PG 120, 1987: GROUP 1. NTP 7TH ANNUAL RPT ON CARCINS, 1994: KNOWN TO BE CARCIN.

Signs And Symptoms Of Overexposure: HLTH HAZ: ING 6:IRRIT, CNS DEPRESS, REPRO & TERATOGENIC EFTS. ING 7:INHAL CAUSES DROW. CNS DEPRESS. ING 8:IRRIT, CNS DEPRESS, DMG TO LIVER & KIDNEYS, REPRO HAZ & TERATOGEN. INGEST: ASPIR MAY CAUSE PNEUMIT. GI DISTURB. IRRIT, NAUS, VOMIT, DI ARR. CNS SYMPS SIMILAR TO THOSE LISTED UNDER INHAL. SKIN: DERM & POSS

Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.

First Aid: EYE:FLUSH W/POTABLE WATER FOR AT LEAST 15 MIN. SEE MD (FP N).

SKIN:FLUSH W/COPIOUS AMTS OF WATER. SEE MD (FP N). INHAL:REMOVE TO FRESH AIR.

SUPPORT BRTHG (GIVE OXYGEN/ARTF RESP) (FP N). INGEST:CALL MD IMMED (FP N).

NOTE TO MD:MOST IMPORTANT SOURCE OF EXPOS IS VIA INHAL. SEVERAL HYDROCARBON COMPONENTS RAPIDLY PASS THRU ALVEOLAR LINING. STOM MUCOSA PROVIDES GREATER BARRIER TO ABSORPTION &

Handling and Disposal

Spill Release Procedures: STOP LEAK. CAUTION. CONTACT CHEMTREC & LOCAL FIRE DEPARTMENT. KEEP AWAY. ISOLATE, DENY ENTRY. STAY UPWIND. VENTILATE. SHUT OFF IGNITION SOURCES. USE WATER SPRAY TO DISPERSE VAPORS. CONTACT NEHC FOR MORE SPECIFIC INFORMATION (FP N).

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS (FP N).

Handling And Storage Precautions: STORE GASOLINE ONLY IN NFPA APPRVD, CLEARLY LABELED CONTRS, TIGHTLY CLSD. NEVER STORE IN GLASS/UNAPPRVD PLASTIC CONTRS. AVOID EYE & SKIN CONT.

Other Precautions: STOR LOCATION MUST BE COOL, DRY, ISOLATED, WELL-VENTD &AWAY FROM HEAT, IGNIT SOURCES & INCOMPATIBLE MATLS. USE GROUNDING WIRES &EQUIP DURING PROD TRANSFER TO REDUCE POSS OF STATIC SPK CAUSED FIRE/EXPLO. CONT NEHC FOR MORE INFO (FP N).

Fire and Explosion Hazard Information

Flash Point Text: -35F,-37C

Lower Limits: 1.4%

Upper Limits: 7.6%

Extinguishing Media: USE DRY CHEMICAL, ALL PURPOSE AFFF, ALCOHOL FOAM OR CARBON DIOXIDE.

Fire Fighting Procedures: WEAR NIOSH APPRVD SCBA & FULL PROT EQUIP (FP N). WATER MAY BE INEFFECTIVE FOR EXTING FIRE BUT MAY BE USED TO COOL FIRE-IMPINGED/EXPANDED CONTRS & (SUP DAT)

Unusual Fire/Explosion Hazard: DANGEROUS WHEN EXPOS TO HEAT/FLAME. VAPS FORM FLAM/EXPLO MIXS W/AIR AT ROOM TEMP, MAY SPREAD TO DIST IGNIT SOURCES & FLASH BACK. CONT NEHC FOR MORE INFO (FP N).

Control Measures

Respiratory Protection: IF EXPOSURE LIMITS ARE EXCEEDED OR IF IRRITATION IS

EXPERIENCED, NIOSH APPROVED RESPIRATORY PROTECTION SHOULD BE WORN.

Ventilation: VENTILATION AND OTHER FORMS OF ENGINEERING CONTROLS ARE THE
PREFERRED MEANS FOR CONTROLLING CHEMICAL EXPOSURES.

Protective Gloves: IMPERVIOUS GLOVES (FP N).

Eye Protection: ANSI APPROVED CHEM WORKERS GOGGLES (FP N).

Other Protective Equipment: ANSI APPROVED EMERGENCY EYEWASH AND DELUGE SHOWER
(FP N). FACESHIELD, APRON, ARMCOVERS, ETC.

Work Hygienic Practices: WASH WORK CLOTHES REGULARLY. DO NOT WEAR CONTAM CLOTHING
NEAR SOURCES OF IGNITION SUCH AS SPARKS/OPEN FLAME, LAUNDRY BEFORE REUSE.

Supplemental Safety and Health: FIRE FIGHT PROC: STRUCTURES. WATER MAY BE USED
TO PROTECT PERSONS & KEEP MATERIAL AWAY FROM IGNITION SOURCES. IF LEAK/SPILL HAS NOT
IGNITED, VENTILATE AREA & USE WATER SPRAY TO DISPERSE GAS/VAPOR & TO PROTECT
PERSONS. FOAM BLANKETS MAY ALSO BE USED TO REDUCE VAPORS & PROTECT RESPONDING
PERSONS. KEEP MATERIAL OUT OF PUBLIC SEWERS & WATERWAYS.

Physical/Chemical Properties

B.P. Text: >80F, >27C

Vapor Pressure: 760 @ 100F

Vapor Density: 1.2

Specific Gravity: 0.72-0.74

Evaporation Rate & Reference: >1

Solubility in Water: NEGLIGIBLE

Appearance and Odor: CLEAR TO AMBER LIQUID WITH A STRONG HYDROCARBON ODOR

Percent Volatiles by Volume: 100

Reactivity Data

Stability Indicator: YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: AVOID CONTACT WITH STRONG OXIDIZERS.

Hazardous Decomposition Products: COMBUSTION MAY PRODUCE CARBON MONOXIDE,
CARBON DIOXIDE, AND REACTIVE HYDROCARBONS.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT.

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

HAZCOM Label

Product ID: GASOLINE MID-GRADE UNLEADED

Cage: JO521

Assigned IND: Y

Company Name: TOSCO

Street: 72 CUMMINGS POINT RD

City: STAMFORD CT

Zipcode: 06901

Health Emergency Phone: 510-228-1220

Label Required IND: Y

Date Of Label Review: 10/21/1997

Status Code: C

Label Date: 10/21/1997

Origination Code: G

Chronic Hazard IND: Y

Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: DANGER

Respiratory Protection IND: YES

Health Hazard: Severe

Contact Hazard: Moderate

Fire Hazard: Severe

Reactivity Hazard: None

Hazard And Precautions: EXTREMELY FLAMMABLE. ACUTE: IRRITATING TO LUNGS, THROAT AND AIRWAYS. SEVERE EYE IRRITATION. CENTRAL NERVOUS SYSTEM DEPRESSION. HARMFUL OR FATAL. IRRITATING TO SKIN. BONE MARROW DEPRESSION AND ANEMIA. PULMONARY EDEMA, SENSE OF CONSTRICTION IN CHEST. DAMAGE TO KIDNEYS AND LIVER. INGESTION: MAY CAUSE ASPIRATION HAZARD-PNEUMONITIS, GASTROINTESTINAL DISTURBANCES, NAUSEA, VOMITING, DIARRHEA. CHRONIC: CANCER HAZARD. CONTAINS BENZENE WHICH IS LISTED AS A HUMAN BLOOD CARCINOGEN, AND GASOLINE WHICH IS LISTED AS AN ANIMAL SKIN CARCINOGEN (FP N). TERATOGEN. KIDNEY AND LIVER DAMAGE.

Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense nor any person or persons contracting with any instrumentality of the United States of America and disclaims all liability for such use. Any person utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department of Defense or other government situation.

TOLUENE

1. Product Identification

Synonyms: Methylbenzene; Toluol; Phenylmethane

CAS No.: 108-88-3

Molecular Weight: 92.14

Chemical Formula: C₆H₅-CH₃

Product Codes:

J.T. Baker: 5375, 5584, 5809, 5812, 9336, 9351, 9364, 9456, 9457, 9459, 9460, 9462, 9466, 9472, 9476

Mallinckrodt: 4483, 8091, 8092, 8604, 8608, 8610, 8611, V560

2. Composition/Information on Ingredients

Ingredient Hazardous	CAS No	Percent
-----	-----	-----
Toluene Yes	108-88-3	100%

3. Hazards Identification

Emergency Overview

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES;
CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Very high concentrations may cause unconsciousness and death.

Ingestion:

Swallowing may cause abdominal spasms and other symptoms that parallel over-exposure from inhalation. Aspiration of material into the lungs can cause chemical pneumonitis, which may be fatal.

Skin Contact:

Causes irritation. May be absorbed through skin.

Eye Contact:

Causes severe eye irritation with redness and pain.

Chronic Exposure:

Reports of chronic poisoning describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated or prolonged contact has a defatting action, causing drying, redness, dermatitis. Exposure to toluene may affect the developing fetus.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or impaired liver or kidney function may be more susceptible to the effects of this substance. Alcoholic beverage consumption can enhance the toxic effects of this substance.

4. First Aid Measures

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. CALL A PHYSICIAN IMMEDIATELY.

Ingestion:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If vomiting occurs, keep head below hips to prevent aspiration into lungs.

Skin Contact:

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 7C (45F) CC

Autoignition temperature: 422C (792F)

Flammable limits in air % by volume:

lcl: 3.3; ucl: 19

Flammable liquid and vapor!

Dangerous fire hazard when exposed to heat or flame. Vapors can flow along surfaces to distant ignition source and flash back.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

Contact with strong oxidizers may cause fire or explosion. Sensitive to static discharge.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Toluene:

- OSHA Permissible Exposure Limit (PEL):

200 ppm (TWA); 300 ppm (acceptable ceiling conc.); 500 ppm (maximum conc.).

- ACGIH Threshold Limit Value (TLV):

50 ppm (TWA) skin, A4 - Not Classifiable as a Human Carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Aromatic benzene-like.

Solubility:

0.05 gm/100gm water @ 20C (68F).

Specific Gravity:

0.86 @ 20C / 4 C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

111C (232F)

Melting Point:

-95C (-139F)

Vapor Density (Air=1):

3.14

Vapor Pressure (mm Hg):

22 @ 20C (68F)

Evaporation Rate (BuAc=1):

2.24

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetroxide; will attack some forms of plastics, rubber, coatings.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Oral rat LD50: 636 mg/kg; skin rabbit LD50: 14100 uL/kg; inhalation rat LC50: 49

gm/m3/4H; Irritation data: skin rabbit, 500 mg, Moderate; eye rabbit, 2 mg/24H, Severe. Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Has shown some evidence of reproductive effects in laboratory animals.

-----\Cancer Lists\-----

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Toluene (108-88-3)	No	No	3

12. Ecological Information

Environmental Fate:

When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. Bioconcentration factor = 13.2 (eels).

Environmental Toxicity:

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TOLUENE

Hazard Class: 3

UN/NA: UN1294

Packing Group: II

Information reported for product/size: 390LB

International (Water, I.M.O.)

Proper Shipping Name: TOLUENE

Hazard Class: 3

UN/NA: UN1294

Packing Group: II

Information reported for product/size: 390LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Toluene (108-88-3)	Yes	Yes	Yes	Yes
-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	--Canada--		Phil.
		DSL	NDSL	
Toluene (108-88-3)	Yes	Yes	No	Yes
-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-		-----SARA 313-----	
Catg.	RQ	TPQ	List	Chemical
Toluene (108-88-3)	No	No	Yes	No
-----\Federal, State & International Regulations - Part 2\-----				
Ingredient	CERCLA	-RCRA-	-TSCA-	
		261.33	8(d)	
Toluene (108-88-3)	1000	U220	No	

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 3[Y]E

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 3 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Label Precautions:

Keep away from heat, sparks and flame.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Avoid breathing vapor.

Avoid contact with eyes, skin and clothing.

Label First Aid:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head below hips to prevent aspiration into lungs. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

1.0 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: PARA-XYLENE

MANUFACTURER/SUPPLIER:

Amoco Chemical Company
200 East Randolph Drive
Chicago, Illinois 60601 U.S.A.

EMERGENCY HEALTH INFORMATION:

1 (800) 447-8735

EMERGENCY SPILL INFORMATION:

1 (800) 424-9300 CHEMTREC (USA)

OTHER PRODUCT SAFETY INFORMATION:

(312) 856-3907

2.0 COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS#	Range % by Wt.
P-Xylene	106-42-3	100 -

(See Section 8.0, "Exposure Controls/Personal Protection", for exposure guidelines)

3.0 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Warning! Flammable. Causes eye and skin irritation. Can be harmful if high concentrations are inhaled. Harmful or fatal if liquid is aspirated into lungs.

POTENTIAL HEALTH EFFECTS:

EYE CONTACT: Causes eye irritation.

SKIN CONTACT: Causes skin irritation.

INHALATION: Can be harmful if high concentrations are inhaled. See "Toxicological Information" section (Section 11.0).

INGESTION: Harmful or fatal if liquid is aspirated into lungs. See "Toxicological Information" section (Section 11.0).

HMIS CODE: (Health:2) (Flammability:3) (Reactivity:0)

NFPA CODE: (Health:2) (Flammability:3) (Reactivity:0)

4.0 FIRST AID MEASURES

EYE: Immediately flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

SKIN: Wash exposed skin with soap and water. Remove contaminated clothing and thoroughly clean and dry before reuse. Get medical attention if irritation develops.

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

INGESTION: If swallowed, do NOT induce vomiting. Get immediate medical attention.

5.0 FIRE FIGHTING MEASURES

FLASHPOINT: 81°F(27°C) ASTM D56

UEL: 7.0%

LEL: 1.1%

AUTOIGNITION TEMPERATURE: 924°F (496°C) (approximate)

FLAMMABILITY CLASSIFICATION: Flammable Liquid.

EXTINGUISHING MEDIA: Agents approved for Class B hazards (e.g., dry chemical, carbon dioxide, foam, steam) or water fog.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Flammable liquid. Vapor may explode if ignited in enclosed area.

FIRE-FIGHTING EQUIPMENT: Firefighters should wear full bunker gear, including a positive pressure self-contained breathing apparatus.

PRECAUTIONS: Keep away from sources of ignition (e.g., heat and open flames). Keep container closed. Use with adequate ventilation.

HAZARDOUS COMBUSTION PRODUCTS: Incomplete burning can produce carbon monoxide and/or carbon dioxide and other harmful products.

6.0 ACCIDENTAL RELEASE MEASURES

Remove or shut off all sources of ignition. Remove mechanically or contain on an absorbent material such as dry sand or earth. Keep out of sewers and waterways.

7.0 HANDLING AND STORAGE

HANDLING: Keep away from ignition sources (e.g., heat, sparks, or open flames). Keep container closed. Use with adequate ventilation.

STORAGE: Store in flammable liquids storage area. Store away from heat, ignition sources, and open flame in accordance with applicable regulations. Keep container closed.

8.0 EXPOSURE CONTROLS / PERSONAL PROTECTION

EYE: Do not get in eyes. Wear chemical goggles.

SKIN: Avoid skin contact. Wear protective clothing and gloves.

INHALATION: Do not breathe mist or vapor. Use with adequate ventilation. If ventilation is inadequate, use NIOSH/MSHA certified respirator that will protect against organic vapor and dust/mist.

ENGINEERING CONTROLS: Control airborne concentrations below the exposure guidelines.

EXPOSURE GUIDELINES:

Component	CAS#	Exposure Limits
P-Xylene	106-42-3	OSHA PEL: 100 ppm (1989)(1971) OSHA STEL: 150 ppm (1989); Not established. (1971) ACGIH TLV-TWA: 100 ppm ACGIH TLV-STEL: 150 ppm

9.0 CHEMICAL AND PHYSICAL PROPERTIES

APPEARANCE AND ODOR: Liquid. Clear. Sweet odor.

pH: Not determined.

VAPOR PRESSURE: 6.4 mm Hg at 20 °C

VAPOR DENSITY: 3.7

BOILING POINT: 282°F(139°C)

MELTING POINT: 56°F(13°C)

SOLUBILITY IN WATER: Negligible, below 0.1%.

SPECIFIC GRAVITY (WATER=1): 0.86

10.0 STABILITY AND REACTIVITY

STABILITY: Burning can be started easily.

CONDITIONS TO AVOID: Keep away from ignition sources (e.g. heat, sparks, and open flames).

MATERIALS TO AVOID: Avoid chlorine, fluorine, and other strong oxidizers.

HAZARDOUS DECOMPOSITION: Burning can produce carbon monoxide and/or carbon dioxide and other harmful products.

HAZARDOUS POLYMERIZATION: Will not occur.

11.0 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA:

EYE IRRITATION: Testing not conducted. See Other Toxicity Data.

SKIN IRRITATION: Testing not conducted. See Other Toxicity Data.

DERMAL LD50: Testing not conducted. See Other Toxicity Data.

ORAL LD50: Testing not conducted. See Other Toxicity Data.

INHALATION LC50: Testing not conducted. See Other Toxicity Data.

OTHER TOXICITY DATA: In humans, overexposure to xylene can cause headache, fatigue, dizziness, listlessness, confusion, irritability, gastrointestinal disturbances (nausea and loss of appetite), flushing of the face, and a feeling of increased body heat. Exposure to xylene vapors above recommended exposure limits (100 ppm - TWA) can cause irritation of the eyes, nose and throat as well as tightening of the chest and staggering gait. Severe overexposure to xylene has been reported to cause irregular heartbeat or rapid incoordinate contractions of the heart, tremors, central nervous system depression, and unconsciousness. Lethality has resulted upon exposure to 10,000 ppm. The odor threshold for xylene is reported to be 1 ppm. Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lung can occur while vomiting after ingestion of this product.

The oral LD50 for xylene is 4300 mg/kg (rat). The inhalation LC50 is 6350 ppm in rats exposed for 4 hours and 3907 ppm in mice exposed for 6 hours.

No significant treatment related effects were seen following inhalation exposure of rats and dogs exposed to 810 ppm for 13 weeks, whereas liver damage and lung inflammation were reported in guinea pigs exposed to 300 ppm for a total of 64 exposures (4 hours per day, 6 days per week).

Xylenes were not teratogenic in rats exposed via inhalation to 100 and 400 ppm, however, adverse effects upon the unborn have been reported at exposure levels producing toxicity in the mother. Xylenes have produced negative results in various genetic toxicity tests, including the AMES assay, mouse lymphoma assay in vitro, rat bone marrow cytogenetic assay in vivo, and a dominant lethal assay.

No component of this product present at levels greater than 0.1% as a carcinogen by NTP, IARC or OSHA.

12.0 ECOLOGICAL INFORMATION

Ecotoxicity Test Data:

Para-xylene (p-xylene, or 4-xylene) is toxic to fish and other aquatic life. Published test results of the acute toxicity of p-xylene for several aquatic species show that concentrations of 2 to 10 mg/L are acutely toxic to most species tested. Acute toxicity endpoints ranged from 2 to 35 mg/L, with a geometric mean of 7 mg/L. The para-isomer appears to be slightly more toxic than the meta- and ortho-isomers.

Biodegradation Potential:

Xylenes have been shown to be readily biodegradable in water using standard protocols with inocula including sewage, activated sludge, and seawater. Field data indicates biodegradation in several situations. However, reports suggest that p-xylene may persist in some groundwater situations. Rates of degradation are expected to vary with environmental conditions and the extent of adaptation of the microbial population.

Bioconcentration Potential:

P-xylene is not expected to bioconcentrate or bioaccumulate. A bioconcentration factor of 138 to 158 is predicted using the estimated octanol-water partition coefficient (log K_{ow}) of 3.12 to 3.2. A bioconcentration factor of 20 was reported for eels. Metabolism and excretion of xylenes has been demonstrated in several organisms, generally via production of toluidic acid. Significant bioconcentrations is unlikely if bioconcentration factors are less than 1000 and the chemical is metabolized.

Other Ecological Information:

P-xylene is expected to volatilize from water and soil with a relatively high Henry's law constant of 0.32, yielding an estimated half-life in water of less than 1 week. Sorption to soil is low to moderate, with the K_{oc} of ortho-xylene being 48-68. Abiotic degradation in air occurs through reaction with photochemically produced hydroxyl radicals, resulting in typical losses of 67-86% per day. Xylenes are likely to move with groundwater from soils and to volatilize from both soil and surface waters.

The potential for long-term ecological effects to intermittent environmental releases is expected to be minimal. However, repeated discharges may cause long-term adverse effects in the aquatic environment.

13.0 DISPOSAL INFORMATION

Disposal must be in accordance with applicable federal, state, or local regulations. Residues and spilled material are hazardous waste due to ignitability.

The container for this product can present explosion or fire hazards, even when emptied! To avoid risk of injury, do not cut, puncture, or weld on or near this container. Since the emptied containers retain product residue, follow label warnings even after container is emptied.

14.0 TRANSPORTATION INFORMATION

U.S. DEPT OF TRANSPORTATION

Shipping Name	Xylenes
Hazard Class	3
Identification Number	UN1307
Packing Group	III
RQ	RQ (Para-Xylene)

INTERNATIONAL INFORMATION:

Sea (IMO/IMDG)

Shipping Name	Xylenes
Class	3.3
Packing Group	III
UN Number	UN1307

Air (ICAO/IATA)

Shipping Name	Xylenes
Class	3
Subsidiary Class	UN1307
Packing Group	III

European Road/Rail (ADR/RID)

Shipping Name Xylenes
Class 3
Item 31°(C)

Canadian Transportation of Dangerous Goods

Shipping Name Xylenes
Hazard Class 3.3
Subsidiary Class 9.2
UN Number UN1307
Packing Group III

15.0 REGULATORY INFORMATION

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR Part 302.4): This product is reportable under 40 CFR Part 302.4 because it contains the following substance(s):

Component/CAS Number	Weight %	Component Reportable Quantity (RQ)
P-Xylene 106-42-3	100	100 lbs.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR Part 355):

This product is not regulated under Section 302 of SARA and 40 CFR Part 355.

SARA TITLE III SECTIONS 311/312 HAZARDOUS CATEGORIZATION (40 CFR Part 370): This product is defined as hazardous by OSHA under 29 CFR Part 1910.1200(d).

SARA TITLE III SECTION 313 (40 CFR Part 372): This product contains the following substance(s), which is on the Toxic Chemicals List in 40 CFR Part 372:

Component/CAS Number	Weight Percent
P-Xylene 106-42-3	100

U.S. INVENTORY (TSCA): Listed on inventory.

OSHA HAZARD COMMUNICATION STANDARD: Flammable liquid. Irritant.

EC INVENTORY (EINECS/ELINCS): In compliance.

JAPAN INVENTORY (MITI): Not determined.

AUSTRALIA INVENTORY (AICS): Not determined.

KOREA INVENTORY (ECL): Not determined.

CANADA INVENTORY (DSL): Not determined.

PHILIPPINE INVENTORY (PICCS): Not determined.

16.0 OTHER INFORMATION

Prepared by:

Environment, Health and Safety Department

Issued: March 28, 1997

Supersedes: February 27, 1996

This Material Safety Data Sheet conforms to the requirements of ANSI Z400.1.

This material safety data sheet and the information it contains is offered to you in good faith as accurate.

We have reviewed any information contained in this data sheet which we received from sources outside

our company. We believe that information to be correct but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents. No warranty is made, either express or implied.

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: PAH Contaminated Soil

Catalog Numbers:

SRS103 100, SRS103100

Synonyms:

API separator sludge

Company Identification: Fisher Scientific

1 Reagent Lane

Fairlawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
50-32-8	Benzo(a)pyrene	0-2	200-028-5
56-55-3	1,2-Benzanthracene	0-2	200-280-6
83-32-9	Acenaphthene	0-2	201-469-6
85-01-8	Phenanthrene	0-2	201-581-5
86-73-7	Fluorene	0-2	201-695-5
87-86-5	Pentachlorophenol	0-2	201-778-6
91-20-3	Naphthalene	0-2	202-049-5
91-57-6	2-methylnaphthalene	0-2	202-078-3
120-12-7	Anthracene	0-2	204-371-1
129-00-0	Pyrene	0-2	204-927-3
132-64-9	Dibenzofuran	0-2	205-071-3
205-99-2	Benzo(b)fluoranthene	0-2	205-911-9
206-44-0	Fluoranthene	0-2	205-912-4

208-96-8	Acenaphthylene	0-2	205-917-1
218-01-9	1,2-benzphenanthrene	0-2	205-923-4
Not available Soil 78-99 unlisted			

Hazard Symbols: None Listed.
Risk Phrases: None Listed.

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: not available.

Caution! Causes skin irritation. Causes eye irritation. May cause allergic skin reaction. Causes digestive tract irritation. May cause digestive tract irritation with nausea, vomiting, and diarrhea. May cause cancer based on animal studies.

Target Organs: None.

Potential Health Effects

Eye:

May cause eye irritation.

Skin:

May cause skin irritation. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material.

Ingestion:

May cause gastrointestinal irritation with nausea, vomiting and diarrhea.

Naphthalene can cause cataracts, optical neuritis, and cornea injuries. Ingestion of large quantities may cause severe hemolytic anemia and

Inhalation:

Causes respiratory tract irritation. May cause effects similar to those described for ingestion.

Chronic:

May cause cancer according to animal studies. Prolonged exposure to respirable crystalline quartz may cause delayed lung injury/fibrosis (silicosis).

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin:

Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists.

Ingestion:

If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Treat symptomatically and

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature: Not available.

Flash Point: Not available.

Explosion Limits, lower: Not available.

Explosion Limits, upper: Not available.

NFPA Rating: Not published.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Vacuum or sweep up material and place into a suitable disposal container. Avoid generating dusty conditions.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash hands before eating. Use with adequate ventilation. Avoid contact with skin and eyes. Keep container tightly closed. Avoid ingestion and inhalation.

Storage:

Store in a cool, dry place.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

+-----+-----+-----+-----+								
-+								
Chemical Name	ACGIH	NIOSH	OSHA - Final PELs					
----- ----- ----- -----								
-								
Benzo(a)pyrene	0.2 mg/m3 (as	none listed	benzene soluble					
benzene solubles)	fraction: 0.2							
(listed under **	mg/m3 TWA							
no name **).	(includes							
anthracene, BaP,								
phenanthrene,								
acridine,								
chrysene, and								
pyrene) (listed								
under ** no								
name **).								
----- ----- ----- -----								
-								


```

| 1,2-Benzanthracene |none listed |none listed |none listed |
|-----|-----|-----|-----|
-|
| Acenaphthene |none listed |none listed |none listed |
|-----|-----|-----|-----|
-|
| Phenanthrene |0.2 mg/m3 (as |none listed |benzene soluble |
| |benzene solubles) | | fraction: 0.2 |
| | (listed under ** | |mg/m3 TWA |
| |no name **). | | (includes |
| | |anthracene, BaP, |
| | |phenanthrene, |
| | |acridine, |
| | |chrysene, and |
| | |pyrene) (listed |
| | |under ** no |
| | |name **). |
|-----|-----|-----|-----|
-|
| Fluorene |none listed |none listed |none listed |
|-----|-----|-----|-----|
-|
| Pentachlorophenol |0.5 mg/m3; skin - |0.5 mg/m3 TWA |0.5 mg/m3 TWA |
| |potential for | 2.5 mg/m3 IDLH | |
| |cutaneous | | |
| |absorption | | |
|-----|-----|-----|-----|
-|
| Naphthalene |10 ppm; 15 ppm |10 ppm TWA; 50 |10 ppm TWA; 50 |
| | STEL; skin - | mg/m3 TWA 250 |mg/m3 TWA |
| |potential for |ppm IDLH | |
| |cutaneous | | |
| |absorption | | |
|-----|-----|-----|-----|
-|
| 2-methylnaphthalene|none listed |none listed |none listed |
|-----|-----|-----|-----|
-|
| Anthracene |0.2 mg/m3 (as |none listed |benzene soluble |
| |benzene solubles) | | fraction: 0.2 |
| | (listed under ** | |mg/m3 TWA |
| |no name **). | | (includes |
| | |anthracene, BaP, |
| | |phenanthrene, |
| | |acridine, |
| | |chrysene, and |
| | |pyrene) (listed |
| | |under ** no |
| | |name **). |
|-----|-----|-----|-----|
-|
| Pyrene |0.2 mg/m3 (as |none listed |benzene soluble |
| |benzene solubles) | | fraction: 0.2 |
| | (listed under ** | |mg/m3 TWA |
| |no name **). | | (includes |
| | |anthracene, BaP, |
| | |phenanthrene, |
| | |acridine, |
| | |chrysene, and |
| | |pyrene) (listed |
| | |under ** no |

```

```

| | | name **). |
|-----|-----|-----| |
|---|---|---|---|
| Dibenzofuran |none listed |none listed |none listed |
|-----|-----|-----| |
|---|---|---|---|
| Benzo(b)fluoranthene|none listed |none listed |none listed |
| e | | | |
|-----|-----|-----| |
|---|---|---|---|
| Fluoranthene |none listed |none listed |none listed |
|-----|-----|-----| |
|---|---|---|---|
| Acenaphthylene |none listed |none listed |none listed |
|-----|-----|-----| |
|---|---|---|---|
| 1,2-benzphenanthrene|0.2 mg/m3 (as |none listed |benzene soluble |
| e |benzene solubles) | | fraction: 0.2 |
| | (listed under ** | |mg/m3 TWA |
| |no name **). | | (includes |
| | |anthracene, BaP, |
| | |phenanthrene, |
| | |acridine, |
| | |chrysene, and |
| | |pyrene) (listed |
| | |under ** no |
| | |name **). |
+-----+-----+-----+
-+

```

OSHA Vacated PELs:

Benzo(a)pyrene:

benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenanthrene, acridine, (listed under ** no name **))

1,2-Benzanthracene:

No OSHA Vacated PELs are listed for this chemical.

Acenaphthene:

No OSHA Vacated PELs are listed for this chemical.

Phenanthrene:

benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenanthrene, acridine, (listed under ** no name **))

Fluorene:

No OSHA Vacated PELs are listed for this chemical.

Pentachlorophenol:

0.5 mg/m3 TWA

Naphthalene:

10 ppm TWA; 50 mg/m3 TWA; 15 ppm STEL; 75 mg/m3 STEL

2-methylnaphthalene:

No OSHA Vacated PELs are listed for this chemical.

Anthracene:

benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenanthrene, acridine, (listed under ** no name **))

Pyrene:

benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenanthrene, acridine, (listed under ** no name **))

Dibenzofuran:

No OSHA Vacated PELs are listed for this chemical.

Benzo(b)fluoranthene:

No OSHA Vacated PELs are listed for this chemical.

Fluoranthene:

No OSHA Vacated PELs are listed for this chemical.

Acenaphthylene:

No OSHA Vacated PELs are listed for this chemical.

1,2-benzphenanthrene:

benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenanthrene, acridine, (listed under ** no name **))

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Solid

Appearance: not available

Odor: none reported

pH: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Evaporation Rate: Not applicable.

Viscosity: Not applicable.

Boiling Point: Not available.

Freezing/Melting Point: Not available.

Decomposition Temperature: Not available.

Solubility in water: Insoluble in water.

Specific Gravity/Density: Not available.

Molecular Formula: Mixture

Molecular Weight: 0

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

High temperatures.

Incompatibilities with Other Materials:

None reported.

Hazardous Decomposition Products:

No data available.

Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:

CAS# 50-32-8: DJ3675000

CAS# 56-55-3: CV9275000

CAS# 83-32-9: AB1000000
CAS# 85-01-8: SF7175000
CAS# 86-73-7: LL5670000
CAS# 87-86-5: SM6300000
CAS# 91-20-3: QJ0525000
CAS# 91-57-6: QJ9635000
CAS# 120-12-7: CA9350000
CAS# 129-00-0: UR2450000
CAS# 132-64-9: HP4430000
CAS# 205-99-2: CU1400000
CAS# 206-44-0: LL4025000
CAS# 208-96-8: AB1254000
CAS# 218-01-9: GC0700000

LD50/LC50:

Not available.

Not available.

Not available.

CAS# 85-01-8: Oral, mouse: LD50 = 700 mg/kg.

CAS# 86-73-7.

CAS# 87-86-5: Draize test, rabbit, eye: 100 uL/24 Mild; Inhalation, mouse: LC50 = 225 mg/m3; Inhalation, rat: LC50 = 355 mg/m3; Oral, mouse: LD50 = 36 mg/kg; Oral, rat: LD50 = 27 mg/kg; Skin, rat: LD50 = 96 mg/kg.

CAS# 91-20-3: Draize test, rabbit, eye: 100 mg Mild; Inhalation, rat: LC50 = >340 mg/m3/1H; Oral, mouse: LD50 = 533 mg/kg; Oral, rat: LD50 = 490 mg/kg; Skin, rabbit: LD50 = >20 gm/kg; Skin, rat: LD50 = >2500 mg/kg.

CAS# 91-57-6: Oral, rat: LD50 = 1630 mg/kg.

CAS# 120-12-7.

CAS# 129-00-0: Draize test, rabbit, skin: 500 mg/24H Mild; Inhalation, rat: LC50 = 170 mg/m3; Oral, mouse: LD50 = 800 mg/kg; Oral, rat: LD50 = 2700 mg/kg.

CAS# 132-64-9.

CAS# 205-99-2.

CAS# 206-44-0: Oral, rat: LD50 = 2 gm/kg; Skin, rabbit: LD50 = 3180 mg/kg.

CAS# 208-96-8: Oral, mouse: LD50 = 1760 mg/kg.

CAS# 218-01-9.

Carcinogenicity:

Benzo(a)pyrene -

ACGIH: A2 - Suspected Human Carcinogen

California: carcinogen; initial date 7/1/87

NIOSH: occupational carcinogen (listed as ** undefined **)

NTP: Suspect carcinogen

OSHA: Possible Select carcinogen

IARC: Group 2A carcinogen

1,2-Benzanthracene -

ACGIH: A2 - Suspected Human Carcinogen

California: carcinogen; initial date 7/1/87

NTP: Suspect carcinogen

OSHA: Possible Select carcinogen

IARC: Group 2A carcinogen

Acenaphthene -

Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

Phenanthrene -

ACGIH: A1 - Confirmed Human Carcinogen (Benzene soluble aerosol)

NIOSH: occupational carcinogen (listed as ** undefined **)

OSHA: Select carcinogen (listed as ** undefined **).

IARC: Group 3 carcinogen

Fluorene -

IARC: Group 3 carcinogen

Pentachlorophenol -
ACGIH: A3 - Animal Carcinogen
California: carcinogen; initial date 1/1/90
Naphthalene -
ACGIH: A4 - Not Classifiable as a Human Carcinogen
2-methylnaphthalene -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Anthracene -
ACGIH: A1 - Confirmed Human Carcinogen (Benzene soluble aerosol)
NIOSH: occupational carcinogen (listed as ** undefined **)
OSHA: Select carcinogen (listed as ** undefined **).
IARC: Group 3 carcinogen
Pyrene -
ACGIH: A1 - Confirmed Human Carcinogen (Benzene soluble aerosol)
NIOSH: occupational carcinogen (listed as ** undefined **)
OSHA: Select carcinogen (listed as ** undefined **).
IARC: Group 3 carcinogen
Dibenzofuran -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Benzo(b)fluoranthene -
ACGIH: A2 - Suspected Human Carcinogen
California: carcinogen; initial date 7/1/87
NTP: Suspect carcinogen
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen
Fluoranthene -
IARC: Group 3 carcinogen
Acenaphthylene -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
1,2-benzphenanthrene -
ACGIH: A3 - Animal Carcinogen
California: carcinogen; initial date 1/1/90
NIOSH: occupational carcinogen (listed as ** undefined **)
OSHA: Select carcinogen (listed as ** undefined **).
IARC: Group 3 carcinogen

**** SECTION 12 - ECOLOGICAL INFORMATION ****

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.
US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: CAS# 50-32-8: waste number U022. CAS# 56-55-3: waste number U018. CAS# 91-20-3: waste number U165. CAS# 206-44-0: waste number U120. CAS# 218-01-9: waste number U050.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
Canadian TDG

No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 50-32-8 is listed on the TSCA inventory.
CAS# 56-55-3 is listed on the TSCA inventory.
CAS# 83-32-9 is listed on the TSCA inventory.
CAS# 85-01-8 is listed on the TSCA inventory.
CAS# 86-73-7 is listed on the TSCA inventory.
CAS# 87-86-5 is listed on the TSCA inventory.
CAS# 91-20-3 is listed on the TSCA inventory.
CAS# 91-57-6 is listed on the TSCA inventory.
CAS# 120-12-7 is listed on the TSCA inventory.
CAS# 129-00-0 is listed on the TSCA inventory.
CAS# 132-64-9 is listed on the TSCA inventory.
CAS# 205-99-2 is not listed on the TSCA inventory.

It is for research and development use only.

CAS# 206-44-0 is listed on the TSCA inventory.
CAS# 208-96-8 is listed on the TSCA inventory.
CAS# 218-01-9 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 91-20-3: Effective Date: June 1, 1987; Sunset Date: June 1, 1997
CAS# 129-00-0: Effective Date: June 1, 1987; Sunset Date: June 1, 1997

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

CAS# 50-32-8: final RQ = 1 pound (0.454 kg)
CAS# 56-55-3: final RQ = 10 pounds (4.54 kg)
CAS# 83-32-9: final RQ = 100 pounds (45.4 kg)
CAS# 85-01-8: final RQ = 5000 pounds (2270 kg)
CAS# 86-73-7: final RQ = 5000 pounds (2270 kg)
CAS# 87-86-5: final RQ = 10 pounds (4.54 kg)
CAS# 91-20-3: final RQ = 100 pounds (45.4 kg)
CAS# 120-12-7: final RQ = 5000 pounds (2270 kg)
CAS# 129-00-0: final RQ = 5000 pounds (2270 kg)
CAS# 132-64-9: final RQ = 100 pound (45.4 kg)
CAS# 205-99-2: final RQ = 1 pound (0.454 kg)
CAS# 206-44-0: final RQ = 100 pounds (45.4 kg)
CAS# 208-96-8: final RQ = 5000 pounds (2270 kg)
CAS# 218-01-9: final RQ = 100 pounds (45.4 kg)

Section 302 (TPQ)

CAS# 129-00-0: TPQ = 1000/10,000 pounds; RQ = 5000 pounds (calculated
TPQ changed after technical review as described in the technical
support document)

SARA Codes

CAS # 50-32-8: acute, chronic.
CAS # 83-32-9: acute.
CAS # 85-01-8: acute.
CAS # 91-20-3: acute, chronic, flammable.
CAS # 91-57-6: acute.
CAS # 120-12-7: acute.
CAS # 129-00-0: acute, chronic.
CAS # 206-44-0: acute.

Section 313

This chemical is not at a high enough concentration to be reportable under Section 313.

This chemical is not at a high enough concentration to be reportable under Section 313.

This chemical is not at a high enough concentration to be reportable under Section 313.

This material contains Pentachlorophenol (CAS# 87-86-5, 0.2%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

This chemical is not at a high enough concentration to be reportable under Section 313.

This chemical is not at a high enough concentration to be reportable under Section 313.

This chemical is not at a high enough concentration to be reportable under Section 313.

This chemical is not at a high enough concentration to be reportable under Section 313.

This chemical is not at a high enough concentration to be reportable under Section 313.

This chemical is not at a high enough concentration to be reportable under Section 313.

Clean Air Act:

CAS# 87-86-5 is listed as a hazardous air pollutant (HAP).

CAS# 91-20-3 is listed as a hazardous air pollutant (HAP).

CAS# 132-64-9 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

CAS# 87-86-5 is listed as a Hazardous Substance under the CWA.

CAS# 91-20-3 is listed as a Hazardous Substance under the CWA.

CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 56-55-3 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 83-32-9 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 86-73-7 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 87-86-5 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 91-20-3 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 120-12-7 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 129-00-0 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 205-99-2 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 208-96-8 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 83-32-9 is listed as a Toxic Pollutant under the Clean Water Act.

CAS# 87-86-5 is listed as a Toxic Pollutant under the Clean Water Act.

CAS# 91-20-3 is listed as a Toxic Pollutant under the Clean Water Act.

CAS# 206-44-0 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

Benzo(a)pyrene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

1,2-Benzanthracene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

Acenaphthene can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

Phenanthrene can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as ** no name **), Massachusetts.

Fluorene can be found on the following state right to know lists: New Jersey, Pennsylvania, Massachusetts.

Pentachlorophenol can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

Naphthalene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

2-methylnaphthalene is not present on state lists from CA, PA, MN, MA, FL, or NJ.

Anthracene can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as ** no name **), Massachusetts.

Pyrene can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as ** no name **), Massachusetts.

Dibenzofuran can be found on the following state right to know lists: New Jersey, Pennsylvania, Massachusetts.

Benzo(b)fluoranthene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

Fluoranthene can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

Acenaphthylene can be found on the following state right to know lists: New Jersey, Pennsylvania, Massachusetts.

1,2-benzphenanthrene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Benzo(a)pyrene, a chemical known to the state of California to cause cancer.

WARNING: This product contains 1,2-Benzanthracene, a chemical known to the state of California to cause cancer.

WARNING: This product contains Pentachlorophenol, a chemical known to the state of California to cause cancer.

WARNING: This product contains Benzo(b)fluoranthene, a chemical known to the state of California to cause cancer.

WARNING: This product contains 1,2-benzphenanthrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

CAS# 50-32-8: no significant risk level = 0.06 ug/day

CAS# 87-86-5: no significant risk level = 40 ug/day
European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: Not available.

Risk Phrases:

Safety Phrases:

WGK (Water Danger/Protection)

CAS# 50-32-8: No information available.

CAS# 56-55-3: No information available.

CAS# 83-32-9: No information available.

CAS# 85-01-8: No information available.

CAS# 86-73-7: No information available.

CAS# 87-86-5: 3

CAS# 91-20-3: 2

CAS# 91-57-6: No information available.

CAS# 120-12-7: 2

CAS# 129-00-0: No information available.

CAS# 132-64-9: No information available.

CAS# 205-99-2: No information available.

CAS# 206-44-0: No information available.

CAS# 208-96-8: No information available.

CAS# 218-01-9: No information available.

United Kingdom Occupational Exposure Limits

CAS# 87-86-5: OES-United Kingdom, TWA 0.5 mg/m3 TWA

CAS# 87-86-5: OES-United Kingdom, STEL 1.5 mg/m3 STEL

CAS# 91-20-3: OES-United Kingdom, TWA 10 ppm TWA; 53 mg/m3 TWA

CAS# 91-20-3: OES-United Kingdom, STEL 15 ppm STEL; 80 mg/m3 STEL

CAS# 91-20-3: OES-United Kingdom, STEL 15 ppm STEL; 80 mg/m3 STEL

Canada

CAS# 50-32-8 is listed on Canada's DSL List.

CAS# 56-55-3 is listed on Canada's NDSL List.

CAS# 83-32-9 is listed on Canada's DSL List.

CAS# 85-01-8 is listed on Canada's DSL List.

CAS# 86-73-7 is listed on Canada's DSL List.

CAS# 87-86-5 is listed on Canada's DSL List.

CAS# 91-20-3 is listed on Canada's DSL List.

CAS# 91-57-6 is listed on Canada's DSL List.

CAS# 120-12-7 is listed on Canada's DSL List.

CAS# 129-00-0 is listed on Canada's DSL List.

CAS# 132-64-9 is listed on Canada's DSL List.

CAS# 206-44-0 is listed on Canada's NDSL List.

CAS# 208-96-8 is listed on Canada's NDSL List.

CAS# 218-01-9 is listed on Canada's DSL List.

This product has a WHMIS classification of D2A.

CAS# 50-32-8 is listed on Canada's Ingredient Disclosure List.

CAS# 56-55-3 is listed on Canada's Ingredient Disclosure List.

CAS# 83-32-9 is listed on Canada's Ingredient Disclosure List.

CAS# 85-01-8 is listed on Canada's Ingredient Disclosure List.

CAS# 86-73-7 is not listed on Canada's Ingredient Disclosure List.

CAS# 87-86-5 is not listed on Canada's Ingredient Disclosure List.

CAS# 91-20-3 is listed on Canada's Ingredient Disclosure List.

CAS# 91-57-6 is not listed on Canada's Ingredient Disclosure List.

CAS# 120-12-7 is listed on Canada's Ingredient Disclosure List.

CAS# 129-00-0 is listed on Canada's Ingredient Disclosure List.

CAS# 132-64-9 is not listed on Canada's Ingredient Disclosure List.

CAS# 205-99-2 is listed on Canada's Ingredient Disclosure List.

CAS# 206-44-0 is listed on Canada's Ingredient Disclosure List.

CAS# 208-96-8 is not listed on Canada's Ingredient Disclosure List.

CAS# 218-01-9 is listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 50-32-8: OEL-AUSTRALIA;Carcinogen
OEL-BELGIUM;Carcinogen
OEL-FINLAND:TWA 0.01 mg/m3;Skin;Carcinogen
OEL-FRANCE;Carcinogen
OEL-GERMANY;Carcinogen
OEL-RUSSIA:STEL 0.00015 mg/m3;Carcinogen
OEL-SWEDEN:TWA 0.005 mg/m3;STEL 0.03 mg/m3;Skin
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV
CAS# 56-55-3: OEL-FRANCE;Carcinogen
CAS# 83-32-9: OEL-RUSSIA:STEL 10 mg/m3
CAS# 85-01-8 (listed as ** undefined **): OEL-UNITED KINGDOM:TWA 0.14 mg/m3 JANUARY 1993
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV
CAS# 86-73-7: Not available.
CAS# 87-86-5: OEL-AUSTRALIA:TWA 0.5 mg/m3;Skin
OEL-BELGIUM:TWA 0.5 mg/m3;Skin
OEL-DENMARK:TWA 0.05 ppm (0.5 mg/m3);Skin
OEL-FINLAND:TWA 0.5 mg/m3;STEL 1.5 mg/m3;Skin
OEL-FRANCE:TWA 0.5 mg/m3;Skin
OEL-GERMANY:TWA 0.005 ppm (0.05 mg/m3);Skin
OEL-HUNGARY:TWA 0.2 mg/m3;STEL 0.4 mg/m3;Skin
OEL-JAPAN:TWA 0.5 mg/m3;Skin
OEL-THE NETHERLANDS:TWA 0.5 mg/m3;Skin
OEL-THE PHILIPPINES:TWA 0.5 mg/m3;Skin
OEL-RUSSIA:STEL 0.1 mg/m3;Skin
OEL-SWEDEN:TWA 0.5 mg/m3;STEL 1.5 mg/m3;Skin JAN9
OEL-SWITZERLAND:TWA 0.05 ppm (0.5 mg/m3);STEL 0.1 ppm;Skin
OEL-TURKEY:TWA 0.5 mg/m3;Skin
OEL-UNITED KINGDOM:TWA 0.5 mg/m3;STEL 1.5 mg/m3;Skin
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV
CAS# 91-20-3: OEL-ARAB Republic of Egypt:TWA 10 ppm (50 mg/m3)
OEL-AUSTRALIA:TWA 10 ppm (50 mg/m3);STEL 15 ppm (75 mg/m3)
OEL-BELGIUM:TWA 10 ppm (52 mg/m3);STEL 15 ppm (79 mg/m3)
OEL-DENMARK:TWA 10 ppm (50 mg/m3)
OEL-FINLAND:TWA 10 ppm (50 mg/m3);STEL 20 ppm (10 mg/m3)
OEL-FRANCE:TWA 10 ppm (50 mg/m3)
OEL-GERMANY:TWA 10 ppm (50 mg/m3)
OEL-HUNGARY:TWA 40 mg/m3;STEL 80 mg/m3;Skin
OEL-THE NETHERLANDS:TWA 10 ppm (50 mg/m3)
OEL-THE PHILIPPINES:TWA 10 ppm (50 mg/m3)
OEL-POLAND:TWA 20 mg/m3
OEL-RUSSIA:STEL 20 mg/m3
OEL-SWITZERLAND:TWA 10 ppm (50 mg/m3)
OEL-UNITED KINGDOM:TWA 10 ppm (50 mg/m3);STEL 15 ppm (75 mg/m3)
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV
CAS# 91-57-6: OEL-RUSSIA:STEL 20 mg/m3
CAS# 120-12-7 (listed as ** undefined **): OEL-UNITED KINGDOM:TWA 0.14 mg/m3 JANUARY 1993
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV
CAS# 129-00-0 (listed as ** undefined **): OEL-UNITED KINGDOM:TWA 0.14 mg/m3 JANUARY 1993
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV
CAS# 205-99-2: OEL-FRANCE;Carcinogen
OEL-GERMANY;Carcinogen
CAS# 206-44-0: Not available.

CAS# 208-96-8: Not available.
CAS# 218-01-9: OEL-AUSTRALIA;Carcinogen
OEL-BELGIUM;Carcinogen
OEL-GERMANY;Carcinogen
OEL-SWITZERLAND;Carcinogen
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 9/02/1997 Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

ENVIRONMENTAL RESOURCE ASSOC -- PCBS IN SOIL (LAB STD), AROCLOR 1260 -- 6665-00N069068

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MSDS Safety Information

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FSC: 6665
MSDS Date: 06/09/1994
MSDS Num: CCBVL
LIIN: 00N069068
Tech Review: 03/13/1996
Product ID: PCBS IN SOIL (LAB STD), AROCLOR 1260
Responsible Party
Cage: 1R664
Name: ENVIRONMENTAL RESOURCE ASSOC
Address: 5540 MARSHALL ST
City: ARVADA CA 80002 US
Info Phone Number: 303-431-8454
Emergency Phone Number: 303-431-8454
Review Ind: N

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Contractor Summary

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Cage: 1R664
Name: ENVIRONMENTAL RESOURCE ASSOCIATES
Address: 5540 MARSHALL STREET
City: ARVADA CO 80002 US
Phone: 303-431-8454

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Ingredients

=====

Cas: 1336-36-3
RTECS #: TQ1350000
Name: POLYCHLORINATED BIPHENYLS (PCBS); (POLYCHLOROBIPHENYLS) (SARA 313)
(CERCLA)
% by Wt: <0.01
OSHA PEL: N/K (FP N)
ACGIH TLV: 1 MG/M3
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB
Ozone Depleting Chemical: N

Name: SOIL; (CLEAN SOIL)
% by Wt: >99.0
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Cas: 11096-82-5
RTECS #: TQ1362000
Name: POLYCHLORINATED BIPHENYL (AROCLOR 1260); (AROCLOR 1260) (SARA 313)
(CERCLA)
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB
Ozone Depleting Chemical: N

Name: SUPDAT:CARCINS, 1994:ANTIC TO BE CARCIN. ANIMAL:LIVER.
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Health Hazards Data

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LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry Inds - Inhalation: YES

Skin: YES

Ingestion: YES

Carcinogenicity Inds - NTP: YES

IARC: YES

OSHA: NO

Effects of Exposure: PRIMARY IRRIT. IRRIT & DMGS ALL TISS. MAY CAUSE LIVER, KIDNEY & LUNG DAMAGE. MAY CAUSE CARDIAC ARRHY, MAY SENSIT HEART TO EPINEPHRINE. MAY CAUSE ALLERGIC DERM/CHLORACNE. MAY CAUSE CANCER OF LIVER OR H EMATOPOEITIC SYS. SYMPS:RED, DRY SCALY SKIN; CRACKING & WEEPING SKIN, COUGH & WHEEZING. JAUNDICE, NAUS (EFTS OF OVEREXP)

Explanation Of Carcinogenicity: POLYCHLOROBIPHENYLS:IARC MONOGRAPHS, SUPP, VOL 7, PG 322, 1987:GROUP 2A. NTP 7TH ANNUAL RPT ON CARCINS. 1994:(SUPDAT)

Signs And Symptions Of Overexposure: EFTS OF OVEREXP:& VOMIT; UREMIA. MAY CAUSE CHLORACNE. CHLOROCARB MATLS HAVE PRDCED SENSIT OF MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE SIMILAR EFT IN HUMANS. ADRENOMIMETICS (E.G., EPINEPHR INE) MAY BE CONTRAINDICATED EXCEPT FOR LIFE-SUSTAINING USES IN HUMANS ACUTELY/CHRONICALLY EXPOSED TO CHLOROCARBS(SUPDAT)

Medical Cond Aggravated By Exposure: DERMATITIS, LIVER DISEASE, KIDNEY DISEASE, ANEMIAS AND LEUKOPENIAS.

First Aid: EYES:IMMEDIATELY FLUSH W/POTABLE WATER FOR A MINIMUM OF 15 MINUTES, SEEK ASSISTANCE FROM MD (FP N). INHALATION:REMOVE FROM EXPOSURE. INGESTION:GIVE SYRUP OF IPECAC 30 CC AND 180 CC (6 OZ) WATER IF SWA LLOWED. SKIN:WASH SKIN.

Handling and Disposal

Spill Release Procedures: VENTILATE AREA. DAMPEN WITH WATER SPRAY TO PREVENT DUST DISPERSION. CALL CLEANUP TEAM. DO NOT FLUSH TO DRAIN OR OPEN WATER.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N). INCINERATE OR DISPOSE AS HAZARDOUS WASTE.

Handling And Storage Precautions: ONLY 1 AROCLOR WILL BE PRESENT IN EACH SAMPLE. AROCLORS ARE ABSORBED TO INERT MICRO-PARTICULATE CLAY. HANDLE WITH CARE. MATERIAL CONTAINS CARCINOGENS.

Other Precautions: NO SMOKING IN AREA OF USE. DO NOT USE IN GEN VICIN OF ARC WELDING, OPEN FLAMES/HOT SURFS. HEAT &/OR UV RADIA MAY CAUSE FORM OF HCL &/OR PHOSGENE (FP N). AVOID BREAKAGE. USE IN AREA WHERE SPILLS CAN BE CONTAINED.

Fire and Explosion Hazard Information

Flash Point Text: NON-FLAMMABLE

Extinguishing Media: MEDIA SUITABLE FOR SURROUNDING FIRE (FP N).

Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA & FULL PROTECTIVE EQUIPMENT (FP N).

Unusual Fire/Explosion Hazard: MAY FORM CARBON MONOXIDE, PHOSGENE, AND CARBONYL BROMIDE IN FIRE. (SIGNIFICANT ONLY IF LG QTY INVOLVED). THERMAL DECOMPOSITION PRODS MAY INCLUDE HCL (FP N).

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED PARTICULATE OR COMBINED VAPOR/PARTICULATE FULL FACE RESPIRATOR OR NIOSH/MSHA APPROVED SELF CONT/POSITIVE PRESSURE FULL FACE UNIT.

Ventilation: LOCAL EXHAUST:USE IN HOOD. SPECIAL:VENTILATE SPILLS.

Protective Gloves: VITON OR NEOPRENE GLOVES.

Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).

Other Protective Equipment: ANSI APPRVD EMER EYEWASH & DELUGE SHOWER (FP N). CHEM IMPERVIOUS CLTHG IF LG AMTS USED. LAB COAT, IMPERVIOUS (SUP DAT)

Work Hygienic Practices: USE CAREFUL LABORATORY TECHNIQUE. AVOID CONTACT.

Supplemental Safety and Health: EFTS OF OVEREXP:(FP N). SEVERAL POLYCHLOROBIPHENYLS ARE ANIMAL POS, HUMAN SUSPECT, CARCINS. THESE SAMPLES SHOULD BE HNDLD W/GREAT CARE. OTHER PROT EQUIP: APRON W/SLEEVE & CLSD SHOES. EXPLAN OF CARCINS: ANTIC TO BE CARCIN. ANIMAL: TUMORS OF LIVER, PITUITARY GLAND, LEUKEMIA. AROCLOR 1260: NTP 7TH ANNUAL RPT ON (ING 4)

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Physical/Chemical Properties

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Solubility in Water: INSOLUBLE

Appearance and Odor: FINE GREY POWDER; ODORLESS.

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Reactivity Data

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Stability Indicator: YES

Stability Condition To Avoid: NONE

Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.

Hazardous Decomposition Products: HCL, PHOSGENE (FP N).

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT

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Toxicological Information

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Ecological Information

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MSDS Transport Information

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Regulatory Information

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Other Information

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HAZCOM Label

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Product ID: PCBS IN SOIL (LAB STD), AROCLOR 1260

Cage: 1R664

Company Name: ENVIRONMENTAL RESOURCE ASSOCIATES

Street: 5540 MARSHALL STREET

City: ARVADA CO

Zipcode: 80002 US

Health Emergency Phone: 303-431-8454

Date Of Label Review: 03/13/1996

Label Date: 03/13/1996

Chronic Hazard IND: Y

Skin Protection IND: YES

Signal Word: WARNING

Respiratory Protection IND: YES

Health Hazard: Moderate

Contact Hazard: Moderate

Fire Hazard: None

Reactivity Hazard: None

Hazard And Precautions: DECOMPOSITION PRODUCTS MAY BE HAZARDOUS.

ACUTE: INHALATION OF VAPORS MAY CONTRIBUTE TO THE OCCURRENCE OF IRREGULAR

HEARTBEAT (FP N). PRIMARY IRRITANT. IRRITATES AND DAMAGES ALL TISSUES. MAY CAUSE LIVER , KIDNEY AND LUNG DAMAGE. MAY CAUSE CARDIAC ARRHYTHMIA, MAY SENSITIZE THE HEART TO EPINEPHRINE. MAY CAUSE ALLERGIC DERMATITIS OR CHLORACNE. SYMPTOMS: RED, DRY SCALY SKIN; CRACKING AND WEEPING SKIN, COUGH AND WHEEZING. JAUNDICE, NAUSEA AND VOMITING; UREMIA. MAY CAUSE CHLORACNE. CHRONIC: CANCER HAZARD. CONTAINS POLYCHLOROBIPHENYLS WHICH ARE LISTED AS ANIMAL LIVER CARCINOGENS (FP N).

Disclaimer (provided with this information by the compiling agencies):

This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense nor any person or persons contracting with any instrumentality of the United States of America and disclaims all liability for such use. Any person utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department of Defense or other government situation.

APPENDIX D

**AIR MONITORING EQUIPMENT
CALIBRATION AND MAINTENANCE**

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

All monitoring instruments must be calibrated and maintained periodically. The limitations and possible sources of errors for each instrument must be understood by the operator. It is important that the operator ensures that the instrument responds properly to the substances it was designed to monitor. Portable air quality monitoring equipment that measures total ionizables present, such as the Photovac Micro-TIP HL-2000, must be calibrated at least once each day using a 10 ppm Isobutylene standard. The appropriate response factor shall be utilized to correspond to the material(s) of concern being monitored. Combustible gas/oxygen/%LEL meters (CGIs) such as the MSA Five Star must be calibrated at least once each week. Real time aerosol monitors, such as the MINI-RAM, must be zeroed at the beginning of each sampling period. The specific instructions for calibration and maintenance provided for each instrument should be followed. The logs maintained for calibration of instruments shall be kept on site. Any malfunctioning equipment will be replaced within 24 hours, or fieldwork will be terminated.

APPENDIX E

ACTIVITY HAZARD ANALYSIS

Project Identification NIMO Site	Location	Estimated Dates 2002 - 2003
Phase of Work General Site Hazards	Page 1 of 2	Analysis Approved by
TASKS	HAZARDS	CONTROL MEASURES
1. General Site Work	a. Slips/trips/falls. b. Manual lifting and material handling. c. Temperature extremes. d. Hand & power tool usage. e. Biological hazards. f. Railroad crossing.	a. Slips/trips/falls. ◆ Maintain good housekeeping, inform workers of trip and fall hazards. b. Manual lifting and material handling. ◆ Use proper lifting techniques, lift with legs not back. Never bend and twist at the waist while lifting, move your feet.. ◆ Team lifting will be used for heavy loads or use mechanical lifting devices. c. Temperature extremes. ◆ Train personnel of signs/symptoms of heat stress ◆ Monitor air temperatures when extreme weather conditions are present ◆ Stay in visual and verbal contact with your buddy d. Hand & power tool usage. ◆ Daily inspections will be performed; ◆ Remove broken or damaged tools from service; ◆ Use the tool for its intended purpose; and ◆ Use in accordance with manufacturers instructions. e. Biological hazards. ◆ Be alert to the presence of biological hazards; ◆ Avoid contact with these hazards; ◆ For ticks: ◆ Self/Buddy check of neck, hairline, groin and body after working in areas that may contain deer ticks ◆ Be alert for signs of stinging insects; and ◆ Keep bee/wasp killer on hand. f. Railroad crossing. ◆ Instruct personnel to be aware of their surroundings; ◆ Maintain alertness to location of tracks; ◆ Stop, look and listen prior to entering crossways; ◆ Do not stop vehicles on tracks; ◆ Only cross if there is no sign of train traffic.

Project Identification NIMO Site	Location	Estimated Dates 2002 - 2003
Phase of Work General Site Hazards	Page 2 of 2	Analysis Approved by
TASKS	HAZARDS	CONTROL MEASURES
	g. Contact with Electricity	g. Contact with Electricity ◆ Ground Fault Circuit Interrupters (GFCI) shall be utilized for all cord and plug equipment. ◆ All extension cords shall have a three-blade grounding plug. ◆ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. ◆ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord. ◆ The Construction Manager shall halt outdoor site operations whenever lightning becomes a hazard, outdoor work will not resume until 30 minutes after the last sighting of lightening.
	h. Striking Underground Utilities	h. Striking Underground Utilities ◆ White line area for drilling or excavating ◆ Call the One Call center to have underground utilities located and marked ◆ On private property a private locatoe will be used. ◆ Work with NIMO personnel in locating underground utility lines.

Project Identification NIMO Site	Location	Estimated Dates 2002 - 2003
Phase of Work Mobilization/Demobilization	Page 1 of 1	Analysis Approved by
TASKS	HAZARDS	CONTROL MEASURES
1. Mobilization and demobilization of equipment, Site tools and personnel.	a. Fall from same level on uneven ground. b. Fall from vehicle/equipment	a. Fall from same level on uneven ground. ♦ Maintain good housekeeping, inform workers of trip and fall hazards. b. Fall from vehicle/equipment ♦ Drivers/Equipment operators use caution on mounting and dismounting the equipment. Check surface before stepping down. Maintain three point contact while climbing onto/from vehicle.
2. Unloading/Loading of vehicles/equipment.	a. Overexertion	a. Overexertion ♦ Utilize rest breaks, provide mechanical equipment for moving material.
3. Unloading/Loading of tools and materials.	a. Contact with electricity	b. Contact with electricity ♦ Only licensed and experienced electricians should work on electrically powered equipment. ♦ Lock Out and Tag Out all equipment and electric circuits before working on them.
4. Working near operating equipment/vehicles.	a. Caught in/on equipment. b. Caught between vehicles c. Struck by vehicle d. Equipment failure	a. Caught in/on equipment. ♦ Workers will not wear loose clothing around operating equipment. ♦ All equipment will be properly guarded and pinch points marked with signage. b. Caught between vehicles ♦ Drivers must maintain workers on foot in vision, if you can't see someone, stop. ♦ Workers on foot must not position themselves between vehicles. c. Struck by vehicle ♦ Drivers must maintain workers on foot in vision, if you can't see someone, stop. ♦ Workers on foot must avoid vehicle blind spots and maintain a safe distance from moving or stopped vehicles/equipment. d. Equipment failure ♦ All equipment should be inspected before use. If any safety problems are noted the equipment should be tagged and removed from service until repaired or replaced.

Project Identification NIMO Site	Location	Estimated Dates 2002 - 2003
Phase of Work Soil Gas Sampling and Excavation of Test Pits and Geophysical Investigation.	Page 1 of 1	Analysis Approved by
TASK	HAZARDS	CONTROL MEASURES
1. Soil Gas Sampling	a. Exposure to soil gas	a. Exposure to soil gas b. Follow air sampling in Monitoring Section 3.3. c. Wear proper PPE as per Table 3-1.
2. Excavation of Test Pits	a. Striking Underground Utilities b. Contact with contaminants/chemical hazards. c. Struck by Heavy Equipment.	a. Striking Underground Utilities ♦ White line area to be excavated. ♦ Contact "One Call" number to have underground utilities located and marked. ♦ On private property a private locating company will be needed and/or a Geophysical Survey will be done. ♦ Maintain reference numbers in the files and update. ♦ Maintain markings for underground utilities. ♦ Hand dig where necessary to ensure location of utility. b. Contact with contaminants/chemical hazards ♦ Wear appropriate PPE per Table 3-1 ♦ Practice contamination avoidance ♦ Conduct real-time air monitoring ♦ Follow proper decontamination procedures ♦ Wash hands/face before eating, drinking or smoking c. Struck by Heavy Equipment. ♦ Drivers/operators must maintain workers on foot in vision, if you can't see someone, stop. ♦ Workers on foot must maintain a safe distance from heavy equipment. ♦ Workers must stay clear of swing radius.
3. Geophysical Investigation	a. Struck by GPR and/or equipment	a. Struck by GPR and/or equipment ♦ Use caution with GPR equipment, ensure ground is not rutted.

Project Identification NIMO Site	Location	Estimated Dates 2002 - 2003
Phase of Work Abandoned underground pipe sampling, Tank investigation	Page 1 of 1	Analysis Approved by
TASK	HAZARDS	CONTROL MEASURES
1. Sample fluid from underground pipes.	a. Exposure to fluids b. Entering excavation c. Overexertion	a. Exposure to fluids ◆ Conduct air monitoring as per Table 3-2 ◆ Wear PPE as specified in Table 3-1 Poly or Saran coveralls. b. Entering excavation ◆ Follow OSHA Excavation and Trenching regulations ◆ Employees shall not enter excavation unless no other way to accomplish sampling is available. ◆ Excavations shall have sides sloped and/or shoring or shielding protection before any entrance. a. Overexertion ◆ Train workers in proper lifting practices and avoiding unusual postures while sampling or other activity. Lift with legs not with back. Never bend, lift and twist in one motion. ◆ Make mechanical equipment available for material handling when needed.
2. Tank investigation	a. Slip/Trip and Fall b. Exposure to tank contents	g. Slip/Trip and Fall ◆ Maintain alertness to slip/trip/fall hazards; ◆ Maintain good housekeeping; ◆ Use fall protection when over 6' high. h. Exposure to tank contents ◆ Conduct air monitoring as per Table 3-2

Project Identification NIMO Site	Location	Estimated Dates 2002 - 2003
Phase of Work Indoor air monitoring and sampling and On site and Off site investigations.	Page 1 of 1	Analysis Approved by
TASK	HAZARDS	CONTROL MEASURES
1. Indoor air monitoring and sampling	a. Exposure to contaminants. b. Hand and power tools	a. Exposure to contaminants. ♦ See 1. (a) above b. Hand and power tools ♦ Inspect tools daily prior to use ♦ Use the proper tool for the job. ♦ Do not lift power tools by cord or hose.
2. Conduct on site investigation 3. Conduct off site investigation.	a. Exposure to contaminants, chemical hazards. b. Heat c. Trip/fall Hazards	a. Exposure to contaminants, chemical hazards. ♦ Wear appropriate PPE per Table 3-1. ♦ Practice contamination avoidance. ♦ Follow proper decontamination procedures. b. Heat ♦ Train personnel about symptoms of heat stress. ♦ Ensure personnel drink plenty of fluids. ♦ Establish work/ rest regimen c. Trip/fall Hazards ♦ Maintain alertness to slip/trip/fall hazards. ♦ Maintain good housekeeping.

Project Identification NIMO Site	Location	Estimated Dates 2002 -2003
Phase of Work Water and Sediment sampling and Decontamination	Page 1 of 1	Analysis Approved by
TASK	HAZARDS	CONTROL MEASURES
1. Water and Sediment sampling.	a. Exposure to contaminants b. Feet caught in mud	a. Exposure to contaminants ♦ See 1 (a) in above AHA b. Feet caught in mud ♦ Wear "Mudders" to enable walking in muddy conditions.
2. Sample handling. a. Samples to be placed in transportation container with ballast.	a. Equipment failure.	a. Equipment failure. ♦ Daily inspections will be performed; ♦ Remove broken or damaged equipment from service and tag; ♦ Use the tool for its intended purpose; and ♦ Use in accordance with manufacturers instructions.
3. Decontamination/ Steam cleaning.	a. Struck by steam/ hot water	a. Struck by steam/hot water ♦ Workers not directly engaged in steam cleaning operations must stay clear. ♦ Workers using steam cleaning equipment should be trained on operation and safety devices/ procedures using the owners/operators manual. ♦ Use face shield and safety glasses or goggles ♦ Stay out of the splash/steam radius ♦ Do not direct steam at anyone ♦ Do not hold objects with your feet or hands ♦ Ensure that direction of spray minimizes spread of constituents of concern ♦ Use shielding as necessary.

APPENDIX F

OSHA HEAT STRESS FACT SHEET

INTRODUCTION.

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in employees engaged in such operations. Such places include: iron and steel foundries, nonferrous foundries, brick-firing and ceramic plants, glass products facilities, rubber products factories, electrical utilities (particularly boiler rooms), bakeries, confectioneries, commercial kitchens, laundries, food canneries, chemical plants, mining sites, smelters, and steam tunnels.

Outdoor operations conducted in hot weather, such as construction, refining, asbestos removal, and hazardous waste site activities, especially those that require workers to wear semi-permeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers.

CAUSAL FACTORS.

Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

DEFINITIONS.

The American Conference of Governmental Industrial Hygienists (1992) states that workers should not be permitted to work when their deep body temperature exceeds 38°C (100.4°F).

Heat is a measure of energy in terms of quantity.

A calorie is the amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5 to 17.5°C).

Conduction is the transfer of heat between materials that contact each other. Heat passes from the warmer material to the cooler material. For example, a worker's skin can transfer heat to a contacting surface if that surface is cooler, and vice versa.

Convection is the transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.

Evaporative cooling takes place when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.

Radiation is the transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.

Globe temperature is the temperature inside a blackened, hollow, thin copper globe.

Metabolic heat is a by-product of the body's activity.

Natural wet bulb (NWB) temperature is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.

Dry bulb (DB) temperature is measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

HEAT DISORDERS AND HEALTH EFFECTS.

HEAT STROKE occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of work load and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

HEAT EXHAUSTION. The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

HEAT CRAMPS are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution ($\pm 0.3\%$ NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

HEAT COLLAPSE ("Fainting"). In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the worker should gradually become acclimatized to the hot environment.

HEAT RASHES are the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

HEAT FATIGUE. A factor that predisposes an individual to heat fatigue is lack of acclimatization. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled sensory-motor, mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

INVESTIGATION GUIDELINES.

These guidelines for evaluating employee heat stress approximate those found in the 1992-1993 ACGIH publication, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

EMPLOYER AND EMPLOYEE INTERVIEWS.

The inspector will review the OSHA 200 Log and, if possible, the OSHA 101 forms for indications of prior heat stress problems.

Following are some questions for employer interviews: What type of action, if any, has the employer taken to prevent heat stress problems? What are the potential sources of heat? What employee complaints have been made?

Following are some questions for employee interviews: What heat stress problems have been experienced? What type of action has the employee taken to minimize heat stress? What is the employer's involvement, i.e.,

does employee training include information on heat stress? (Appendix III:4-1 lists factors to be evaluated when reviewing a heat stress situation, and Appendix III:4-2 contains a follow-up checklist.)

WALKAROUND INSPECTION. During the walk around inspection, the investigator will: determine building and operation characteristics; determine whether engineering controls are functioning properly; verify information obtained from the employer and employee interviews; and perform temperature measurements and make other determinations to identify potential sources of heat stress. Investigators may wish to discuss any operations that have the potential to cause heat stress with engineers and other knowledgeable personnel. The walk around inspection should cover all affected areas. Heat sources, such as furnaces, ovens, and boilers, and relative heat load per employee should be noted.

WORK-LOAD ASSESSMENT.

Under conditions of high temperature and heavy workload, the CSHO should determine the work-load category of each job (Table III:4-1 and Figure III:4-1). Work-load category is determined by averaging metabolic rates for the tasks and then ranking them:

Light work: up to 200 kcal/hour

Medium work: 200-350 kcal/hour

Heavy work: 350-500 kcal/hour

Cool Rest Area: Where heat conditions in the rest area are different from those in the work area, the metabolic rate (M) should be calculated using a time-weighted average, as follows:

Equation III:4-1. Average Metabolic Rate

where: M = metabolic rate
 t = time in minutes

In some cases, a videotape is helpful in evaluating work practices and metabolic load.

FIGURE III:4-1. ACTIVITY EXAMPLES Light hand work: writing, hand knitting

Heavy hand work: typewriting

Heavy work with one arm: hammering in nails (shoemaker, upholsterer)

Light work with two arms: filing metal, planing wood, raking the garden

Moderate work with the body: cleaning a floor, beating a carpet

Heavy work with the body: railroad track laying, digging, barking trees

Sample Calculation: Assembly line work using a heavy hand tool

Walking along 2.0 kcal/min

Intermediate value between heavy work with two arms and light work with the body 3.0 kcal/min

Add for basal metabolism 1.0 kcal/min

Total: 6.0 kcal/min

Source: ACGIH 1992.

TABLE III:4-1. ASSESSMENT OF WORK

Body position and movement kcal/min*

Sitting 0.3

Standing 0.6

Walking 2.0-3.0

Walking uphill add 0.8 for every meter (yard) rise

Type of work	Average kcal/min	Range kcal/min
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Hand work

Light 0.4 0.2-1.2

Heavy 0.9

Work: One arm

Light 1.0 0.7-2.5

Heavy 1.7

Work: Both arms

Light 1.5 1.0-3.5

Heavy 2.5

Work: Whole body

Light 3.5 2.5-15.0

Moderate 5.0

Heavy 7.0

Very heavy 9.0

* For a "standard" worker of 70 kg body weight (154 lbs.) and 1.8m² body surface (19.4 ft²).

Source: ACGIH 1992.

SAMPLING METHODS.

BODY TEMPERATURE MEASUREMENTS. Although instruments are available to estimate deep body temperature by measuring the temperature in the ear canal or on the skin, these instruments are not sufficiently reliable to use in compliance evaluations.

ENVIRONMENTAL MEASUREMENTS. Environmental heat measurements should be made at, or as close as possible to, the specific work area where the worker is exposed. When a worker is not continuously exposed in a single hot area but moves between two or more areas having different levels of environmental heat, or when the environmental heat varies substantially at a single hot area, environmental heat exposures should be measured for each area and for each level of environmental heat to which employees are exposed.

WET BULB GLOBE TEMPERATURE INDEX.

Wet Bulb Globe Temperature (WBGT) should be calculated using the appropriate formula in Appendix III:4-2. The WBGT for continuous all-day or several hour exposures should be averaged over a 60-minute period. Intermittent exposures should be averaged over a 120-minute period. These averages should be calculated using the following formula:

Equation III:4-2. Average Wet Bulb Globe Temperature (WBGT)

For indoor and outdoor conditions with no solar load, WBGT is calculated as:

$$WBGT = 0.7NWB + 0.3GT$$

For outdoors with a solar load, WBGT is calculated as

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Nature Wet-Bulb Temperature

DB = Dry-Bulb Temperature
GT = Globe Temperature

The exposure limits in Table III:4-2 are valid for employees wearing light clothing. They must be adjusted for the insulation from clothing that impedes sweat evaporation and other body cooling mechanisms. Use Table III:4-3 to correct Table III:4-2 for various kinds of clothing.

Use of Table III:4-2 requires knowledge of the WBGT and approximate workload. Workload can be estimated using the data in Table III:4-1, and sample calculations are presented in Figure III:4-1.

MEASUREMENT. Portable heat stress meters or monitors are used to measure heat conditions. These instruments can calculate both the indoor and outdoor WBGT index according to established ACGIH Threshold Limit Value equations. With this information and information on the type of work being performed, heat stress meters can determine how long a person can safely work or remain in a particular hot environment. See Appendix III:4-2 for an alternate method of calculation.

TABLE III:4-2. PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES ----- Work Load* -----

Work/rest regimen Light Moderate Heavy

Continuous work 30.0°C (86°F) 26.7°C (80°F) 25.0°C (77°F)

75% Work, 25% rest, each hour 30.6°C (87°F) 28.0°C (82°F) 25.9°C (78°F)

50% Work, 50% rest, each hour 31.4°C (89°F) 29.4°C (85°F) 27.9°C (82°F)

25% Work, 75% rest, each hour 32.2°C (90°F) 31.1°C (88°F) 30.0°C (86°F)

*Values are in °C and °F, WBGT.

These TLV's are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C (100.4° F). They are also based on the assumption that the WBGT of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average should be used (consult the ACGIH 1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1992).

These TLV's apply to physically fit and acclimatized individuals wearing light summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLV's in Table III:4-2 must be reduced by the corrections shown in Table III:4-3.

Source: ACGIH 1992.

OTHER THERMAL STRESS INDICES.

The Effective Temperature index (ET) combines the temperature, the humidity of the air, and air velocity. This index has been used extensively in the field of comfort ventilation and air-conditioning. ET remains a useful measurement technique in mines and other places where humidity is high and radiant heat is low.

The Heat-Stress Index (HSI) was developed by Belding and Hatch in 1965. Although the HSI considers all environmental factors and work rate, it is not completely satisfactory for determining an individual worker's heat stress and is also difficult to use.

TABLE III:4-3. WBGT CORRECTION FACTORS IN °C Clothing type Clo* value WBGT correction

Summer lightweight working clothing 0.6 0

Cotton coveralls 1.0 -2

Winter work clothing 1.4 -4

Water barrier, permeable 1.2 -6

*Clo: Insulation value of clothing. One clo = 5.55 kcal/m²/hr of heat exchange by radiation and convection for each degree °C difference in temperature between the skin and the adjusted dry bulb temperature.

Note: Deleted from the previous version are trade names and "fully encapsulating suit, gloves, boots and hood" including its clo value of 1.2 and WBGT correction of -10.

Source: ACGIH 1992.

CONTROL.

Ventilation, air cooling, fans, shielding, and insulation are the five major types of engineering controls used to reduce heat stress in hot work environments. Heat reduction can also be achieved by using power assists and tools that reduce the physical demands placed on a worker.

However, for this approach to be successful, the metabolic effort required for the worker to use or operate these devices must be less than the effort required without them. Another method is to reduce the effort necessary to operate power assists. The worker should be allowed to take frequent rest breaks in a cooler environment.

ACCLIMATIZATION.

The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimatization. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The worker will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.

A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods. NIOSH (1986) says that, for workers who have had previous experience in jobs where heat levels are

high enough to produce heat stress, the regimen should be 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.

FLUID REPLACEMENT. Cool (50°-60°F) water or any cool liquid (except alcoholic beverages) should be made available to workers to encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

ENGINEERING CONTROLS.

General ventilation is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). This technique clearly works better in cooler climates than in hot ones. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.

Air treatment/air cooling differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.

Air conditioning is a method of air cooling, but it is expensive to install and operate. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed; chillers are more efficient in cooler climates or in dry climates where evaporative cooling can be used.

Local air cooling can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller. The main advantage of a blower, aside from portability, is minimal set-up time.

Another way to reduce heat stress is to increase the air flow or convection using fans, etc. in the work area (as long as the air temperature is less than the worker's skin temperature). Changes in air speed can help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the worker directly to be effective.

If the dry bulb temperature is higher than 35°C (95°F), the hot air passing over the skin can actually make the worker hotter. When the temperature is more than 35°C and the air is dry, evaporative cooling may be improved by air movement, although this improvement will be offset by the convective heat. When the temperature exceeds 35°C and the relative humidity is 100%, air movement will make the worker hotter. Increases in air speed have no effect on the body temperature of workers wearing vapor-barrier clothing.

Heat conduction methods include insulating the hot surface that generates the heat and changing the surface itself.

Simple engineering controls, such as shields, can be used to reduce radiant heat, i.e. heat coming from hot surfaces within the worker's line of sight. Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the worker's heat load. Flat black surfaces absorb heat more than smooth, polished ones. Having cooler surfaces surrounding the worker assists in cooling because the worker's body radiates heat toward them.

With some sources of radiation, such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat. Instead of reducing radiation from the source, shielding can be used to interrupt the path between the source and the worker. Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

Shields should be located so that they do not interfere with air flow, unless they are also being used to reduce convective heating. The reflective surface of the shield should be kept clean to maintain its effectiveness.

ADMINISTRATIVE CONTROLS AND WORK PRACTICES.

Training is the key to good work practices. Unless all employees understand the reasons for using new, or changing old, work practices, the chances of such a program succeeding are greatly reduced.

NIOSH (1986) states that a good heat stress training program should include at least the following components:

- Knowledge of the hazards of heat stress;
- Recognition of predisposing factors, danger signs, and symptoms;
- Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
- Employee responsibilities in avoiding heat stress;
- Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
- Use of protective clothing and equipment; and
- Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs.

Hot jobs should be scheduled for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

WORKER MONITORING PROGRAMS.

Every worker who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semi-permeable or impermeable clothing when the temperature exceeds 21°C (69.8°F), working at extreme metabolic loads (greater than 500 kcal/hour), etc.

Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P1) with the pulse rate taken at 2.5 minutes (P3) after the rest break starts. The two pulse rates can be interpreted using Table III:4-4.

Oral temperature can be checked with a clinical thermometer after work but before the employee drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one third.

Body water loss can be measured by weighing the worker on a scale at the beginning and end of each work day. The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, fluid intake should increase.

OTHER ADMINISTRATIVE CONTROLS. The following administrative controls can be used to reduce heat stress:

Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects;

Provide recovery areas, e.g., air-conditioned enclosures and rooms;

Use shifts, e.g., early morning, cool part of the day, or night work;

Use intermittent rest periods with water breaks;

Use relief workers;

Use worker pacing; and

Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.

TABLE III:4-4. HEART RATE RECOVERY CRITERIA Heart rate recovery pattern P3 Difference between P1 and P3

Satisfactory recovery

High recovery (Conditions may require further study)

No recovery (May indicate too much stress) <90

90

90 --

10

<10

PERSONAL PROTECTIVE EQUIPMENT.

REFLECTIVE CLOTHING, which can vary from aprons and jackets to suits that completely enclose the worker from neck to feet, can stop the skin from absorbing radiant heat. However, since most reflective clothing does not allow air exchange through the garment, the reduction of radiant heat must more than offset the corresponding loss in evaporative cooling. For this reason, reflective clothing should be worn as loosely as possible. In situations where radiant heat is high, auxiliary cooling systems can be used under the reflective clothing.

AUXILIARY BODY COOLING.

Commercially available ice vests, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. Carbon dioxide (dry ice) can also be used as a coolant. The cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary. However, ice vests do not encumber the worker and thus permit maximum mobility. Cooling with ice is also relatively inexpensive.

Wetted clothing is another simple and inexpensive personal cooling technique. It is effective when reflective or other impermeable protective clothing is worn. The clothing may be wetted terry cloth coveralls or wetted two-piece, whole-body cotton suits. This approach to auxiliary cooling can be quite effective under conditions of high temperature and low humidity, where evaporation from the wetted garment is not restricted.

Water-cooled garments range from a hood, which cools only the head, to vests and "long johns," which offer partial or complete body cooling. Use of this equipment requires a battery-driven circulating pump, liquid-ice coolant, and a container.

Although this system has the advantage of allowing wearer mobility, the weight of the components limits the amount of ice that can be carried and thus reduces the effective use time. The heat transfer rate in liquid cooling systems may limit their use to low-activity jobs; even in such jobs, their service time is only about 20 minutes per pound of cooling ice. To keep outside heat from melting the ice, an outer insulating jacket should be an integral part of these systems.

Circulating air is the most highly effective, as well as the most complicated, personal cooling system. By directing compressed air around the body from a supplied air system, both evaporative and convective cooling are improved. The greatest advantage occurs when circulating air is used with impermeable garments or double cotton overalls.

One type, used when respiratory protection is also necessary, forces exhaust air from a supplied-air hood ("bubble hood") around the neck and down inside an impermeable suit. The air then escapes through openings in the suit. Air can also be supplied directly to the suit without using a hood in three ways:

- by a single inlet;
- by a distribution tree; or
- by a perforated vest.

In addition, a vortex tube can be used to reduce the temperature of circulating air. The cooled air from this tube can be introduced either under the clothing or into a bubble hood. The use of a vortex tube separates the air stream into a hot and cold stream; these tubes also can be used to supply heat in cold climates. Circulating air, however, is noisy and requires a constant source of compressed air supplied through an attached air hose.

One problem with this system is the limited mobility of workers whose suits are attached to an air hose. Another is that of getting air to the work area itself. These systems should therefore be used in work areas where workers are not required to move around much or to climb. Another concern with these systems is that they can lead to dehydration. The cool, dry air feels comfortable and the worker may not realize that it is important to drink liquids frequently.

RESPIRATOR USAGE. The weight of a self-contained breathing apparatus (SCBA) increases stress on a worker, and this stress contributes to overall heat stress. Chemical protective clothing such as totally encapsulating chemical protection suits will also add to the heat stress problem.

APPENDIX III: 4-2. HEAT STRESS-RELATED ILLNESS OR ACCIDENT FOLLOW-UP.

Describe events leading up to the episode.

Evaluation/comments by other workers at the scene.

Work at time of episode (heavy, medium, light)?

How long was affected employee working at site prior to episode?

Medical history of affected worker, if known.

Appropriate engineering controls in place?

Appropriate engineering controls in operation?

Appropriate work practices used by affected employee(s)?

Appropriate personal protective equipment available?

Appropriate personal protective equipment in use?

Medical screening for heat stress and continued surveillance for signs of heat stress given other employees?

Additional comments regarding specific episode(s): (Use additional pages as needed.)

APPENDIX III: 4-3. MEASUREMENT OF WET BULB GLOBE TEMPERATURE.

Measurement is often required of those environmental factors that most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, the Wet Bulb Globe Temperature Index (WBGT) is the most used technique to measure these environmental factors. WBGT values are calculated by the following equations:

Equation III:4-4. Indoor or Outdoor Wet Bulb Globe Temperature Indexes (WBGI)

Indoor or outdoors with no solar load

$$WBGT = 0.7NWB + 0.3GT$$

Outdoors with solar load

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Natural Wet-Bulb Temperature
DB = Dry-Bulb (air) Temperature
GT = Globe Thermometer Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. The measurement of environmental factors shall be performed as follows:

1. The range of the dry and the natural wet-bulb thermometers should be -5°C to $+50^{\circ}\text{C}$, with an accuracy of $\pm 0.5^{\circ}\text{C}$. The dry bulb thermometer must be shielded from the sun and the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet bulb thermometer should be kept wet with distilled water for at least one-half hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillary. The wick must be wetted by direct application of water from a syringe one-half hour before each reading. The wick must cover the bulb of the thermometer and an equal length of additional wick must cover the stem above the bulb. The wick should always be clean, and new wicks should be washed before using.
2. A globe thermometer, consisting of a 15 cm (6-inch) in diameter hollow copper sphere painted on the outside with a matte black finish, or equivalent, must be used. The bulb or sensor of a thermometer (range -5°C to $+100^{\circ}\text{C}$ with an accuracy of $\pm 0.5^{\circ}\text{C}$) must be fixed in the center of the sphere. The globe thermometer should be exposed at least 25 minutes before it is read.
3. A stand should be used to suspend the three thermometers so that they do not restrict free air flow around the bulbs and the wet-bulb and globe thermometer are not shaded.
4. It is permissible to use any other type of temperature sensor that gives a reading similar to that of a mercury thermometer under the same conditions.
5. The thermometers must be placed so that the readings are representative of the employee's work or rest areas, as appropriate.

Once the WBGT has been estimated, employers can estimate workers' metabolic heat load (see Tables III:4-1 and III:4-2) and use the ACGIH method to determine the appropriate work/rest regimen, clothing, and equipment to use to control the heat exposures of workers in their facilities.

Appendix 1A

New York State Department of Health Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.
4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed $150 \text{ mcg}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than $150 \text{ mcg}/\text{m}^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within $150 \text{ mcg}/\text{m}^3$ of the upwind level and in preventing visible dust migration.

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

December 2009

Appendix 1B

Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.
2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.
3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM₁₀) with the following minimum performance standards:
 - (a) Objects to be measured: Dust, mists or aerosols;
 - (b) Measurement Ranges: 0.001 to 400 mg/m³ (1 to 400,000 :ug/m³);
 - (c) Precision (2-sigma) at constant temperature: +/- 10 :g/m³ for one second averaging; and +/- 1.5 g/m³ for sixty second averaging;
 - (d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
 - (e) Resolution: 0.1% of reading or 1g/m³, whichever is larger;
 - (f) Particle Size Range of Maximum Response: 0.1-10;
 - (g) Total Number of Data Points in Memory: 10,000;
 - (h) Logged Data: Each data point with average concentration, time/date and data point number
 - (i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
 - (j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
 - (k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
 - (l) Operating Temperature: -10 to 50° C (14 to 122° F);
 - (m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.
4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.
5. The action level will be established at 150 ug/m³ (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m³, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m³ above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m³ continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM₁₀ at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

- (a) Applying water on haul roads;
- (b) Wetting equipment and excavation faces;
- (c) Spraying water on buckets during excavation and dumping;
- (d) Hauling materials in properly tarped or watertight containers;
- (e) Restricting vehicle speeds to 10 mph;
- (f) Covering excavated areas and material after excavation activity ceases; and
- (g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m³ action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Introduction

This COVID-19 H&S Plan Addendum is intended to provide guidance to BC field personnel on identified hazards and controls for potential exposure to COVID-19 infectious illness while working outside of the office on BC projects. This document is intended to be included as an addendum to project-specific BC (Health and Safety) H&S Plans. Additional BC procedures and guidance documents are referenced in this document and are available to all BC personnel through BC's [Coronavirus Resource Page](#).

Definitions

COVID-19 Symptoms - COVID-19 is associated with a wide range of symptoms and may depend on the variant of COVID-19 (i.e., Alpha, Delta, Omicron, etc.). Symptoms may appear 2-14 days after exposure to the virus and may range from mild to severe. With the Omicron variant, symptoms usually appear between day 3 – 6 following exposure, but in rare instance may not appear until days 10-14 following exposure. The most common symptoms for COVID-19 include the following (NOTE: This list does not include all possible symptoms):

Most common symptoms

- ✓ Fever with temp > 100.4°F/38 °C
- ✓ Sore throat
- ✓ Dry cough
- ✓ Fatigue or tiredness
- ✓ Congestion or runny nose
- ✓ Nausea or vomiting

Less common symptoms

- ✓ Muscle or body aches and pains (chills/shaking)
- ✓ Diarrhea
- ✓ Conjunctivitis/Eye irritation
- ✓ Headache of unknown origin
- ✓ New loss of taste or smell
- ✓ Skin rash or discoloration of toes or fingers

Serious symptoms

- ✓ Shortness of breath /difficulty breathing
- ✓ Persistent chest pain or pressure
- ✓ New confusion or loss of speech/movement
- ✓ Bluish lips or face
- ✓ Difficulty waking or inability to stay awake

Close Contact - Living in the same household or caring for someone who's infected, direct exposure from someone who's infected (e.g., being coughed/sneezed on), or being within 6 feet of a diagnosed or presumed infected person for a cumulative total of 15 or 30 minutes or more over a 24-hour period starting from 2 days before illness onset:

- ✓ For Enclosed/Constrained Environments: <6 feet for cumulative period of 15 minutes over 24-hours.
- ✓ For Open Air/Unconstrained Environments: <6 feet for cumulative period of 30 minutes over 24-hours.

Vaccinated – Individuals are considered vaccinated two weeks after receiving their final dose of an FDA-approved COVID-19 vaccine (one-dose or two-dose versions).

Recently Vaccinated – Individuals are considered *recently* vaccinated and at the highest level of protection when they have completed the full course of the initial vaccination within the past 6 months (for two dose vaccines) or 2 months (for single dose vaccines) and for those that are booster eligible, if they have also had a booster shot within the last 6 months.

Note: If you have a condition or are taking medications that weaken your immune system, you may NOT be fully protected even if you are fully vaccinated. Also, vaccination does not mean you are immune from the virus. Transmission still occurs from vaccinated individuals. Vaccination is highly effective at reducing the risk of serious illness and hospitalization. Talk to your healthcare provider. Even after vaccination, you may need to continue taking all precautions.

Pre-Field Mobilization Review and Travel Planning

Moving forward with employee travel assumes that employees are free of symptoms of COVID-19 for the 48-hours prior to initial travel dates and have not knowingly been in close contact with an infected individual.

NOTE: Pre-authorization for travel is not required.

If an employee is being asked to travel to a location and feels uncomfortable regarding the destination and/or method of travel, please elevate your concern to your project manager and/or supervisor for further discussion and engage your project Safety Manager for further support/consultation if necessary. Please refer to the additional sections within this SOP for BC's minimum expectations regarding travel and employee precautions.

Local Travel Advisories and CDC Domestic Travel Recommendations

Prior to travel employees should review any travel advisories applicable in the jurisdiction they are traveling to as well as any requirements that may apply when they arrive back home. Employees are encouraged to reach out to the COVID Team (COVIDinfo@Brwncauld.com) if there are any questions related to travel requirements (domestic or international). In addition, Employees should be aware of local jurisdictional requirements or limitations for vaccinated and unvaccinated individuals.

For guidance on minimum expectations regarding specific aspects of company travel, that includes vehicle usage, hotel stays, public transportation, rideshare services and air travel, please consult the procedures outlined in the current version of BC's *COVID-19 General Travel SOP*. ***In general, BC is pointing employee to CDC guidance and allowing them to make their own choices. The exception is that employees are required to wear face masks when using public transportation and/or accessing public transportation hubs when mandated by CDC and TSA requirements.***

Procedures

For activities conducted outside of an office environment, this addendum document will be added to the appendices of the existing project-specific H&S Plan and implemented, as applicable, for the work and environmental conditions.

! NOTE: Do not come to work if you are experiencing COVID-like symptoms or if you have been in close contact with a positive COVID case or suspected COVID case within the past 14 days. Contact your supervisor for further instructions.

Documented Daily Wellness Screening (Only if required by client or local regulation):

- ✓ On a daily basis, all site personnel, BC employees and subcontractors, are required to participate in a COVID-19 Wellness Screening Questionnaire review prior to start of work. A paper form **COVID-19 Tailgate Wellness Check Log** (Attachment A) is to be used, unless the client requires use of a different form.
- ✓ Temperature screening as a site entry requirement may be implemented by some clients or required by local regulation. If temperature screening is implemented at the worksite, the team shall be prepared by having a digital forehead thermometer and sanitation supplies available. Individuals shall preferably take their own temperature with a sanitized thermometer, or a designated individual may take everyone's temperature while all parties are wearing face masks while completing temperature screening. Pass/fail results shall be documented on the paper copy of the Tailgate Wellness Log (or client-supplied form). Additional detail is provided in BC's **COVID-19 Wellness Screening with Temperature Monitoring for BC Offices and Work Sites** procedure.

Face Masks:

Face masks are no longer mandatory when accessing BC outdoor field work locations and indoor construction trailers or conference rooms. However, local jurisdictions (i.e., state, county, town) or the client may have their own mask mandates, which BC employees and subcontractors are expected to comply with when applicable to a worksite. It is important for project team members to identify applicable local restrictions prior to start of work and to communicate those requirements to all team members. BC employees are expected to have an appropriate face mask readily available in case it is required to be donned. Larger projects should continue to maintain a supply of face masks for BCers and visitors who want to use them.

Face masks are still **required** in the following work situations:

- ✓ When there is a legal jurisdictional requirement (i.e. CDC, TSA, state or local regulation) or when a client/facility mandates the use of face masks; or
- ✓ When an individual starts to experience COVID symptoms while at a worksite and needs to safely exit the site; or
- ✓ When an employee who has been affected by COVID-19 (i.e., they are ill with COVID-like symptoms, tested positive for COVID-19, or has been in close contact with someone who has COVID-19 or COVID-like symptoms), they may be authorized to return to work **by BC COVID case manager** using the CDC Guidance for shortening their quarantine/isolation period (i.e., the “5+5 protocol”)

When face masks are worn, users should select well-fitting masks worn correctly for maximum protection so that they cover the nose and mouth. Approved types of face masks include:

- ✓ N/KN95 mask
- ✓ 3-ply Disposable surgical masks
- ✓ Fabric face masks* with at least two layers of tightly woven fabric that do not allow light pass through.

***Note:** fabric balaclava/neck gaiters are no longer acceptable when protocol require face coverings.

Important: When working in a field environment where Flame Resistant (FR) or Arc Rated (AR) protective clothing is required, if face coverings must be worn they must be rated for the hazard (i.e., FR or AR). Examples of rated face protection include balaclavas and neck gaiters.

Note: Foggy glasses while wearing a mask and safety glasses should not be used as a reason to not wear one or the other. Rather the foggy glasses should be managed appropriately.

Testing for COVID-19:

Testing for COVID-19 is required when:

- (1) A client requires routine testing;
- (2) A client or local law requires negative test results in lieu of proof of vaccination; or
- (3) When an employee affected by COVID-19 (symptomatic, close contact scenarios, or positive test result) is authorized by a BC COVID Case Manager to return to work under CDC’s protocol for shortened isolation or quarantine.

The type of COVID-19 test (i.e., Molecular tests, like a PCR or an antigen test) depends on the situation. You’ll be advised by your PM, H&S manager, or COVID case manager. You will also be advised if you must provide documentation of your COVID-19 test results to BC. When there are client requirements associated with testing, BC will provide you with a link to the confidential, secure website to upload your results.

Worksite Infection Control Best Practices:

The following are additional, general controls that should continue to be implemented at BC project Sites:

- ✓ Per CDC, continue to aim for maintaining social distancing spacing of 6 ft (2m) with other persons, when possible.
- ✓ Follow good personal hygiene practices including washing hands frequently (or using hand sanitizer frequently), covering of mouth with your arm and stepping away from other people for coughs or sneezes, utilizing tissues with immediate disposal following use, etc.
- ✓ Continue to avoid direct skin-to-skin contact with individuals as much as possible, such as handshakes.
- ✓ Where possible, continue holding daily tailgate meetings and other larger group meetings in outdoor or open spaces to allow for social distancing and good ventilation.
- ✓ Avoid use of a common water cooler/dispensing jug. Provide individual water bottles or ask field personnel to bring/maintain their own individual bottle, consistent with BC minimum requirements defined within the project H&S Plan.
- ✓ Routinely clean all frequently touched surfaces in workspaces (e.g., workstations, countertops, tables, and doorknobs), shared vehicles (e.g. steering wheel, shifter, seats, door handles, console), and shared equipment.
- ✓ Following a recent case of COVID-19 (or COVID-19 like illness), disinfect the work surface or tools the affected person may have used within the prior 24 hours.
- ✓ Use disposable nitrile gloves when using disinfection chemicals to wipe potentially contaminated surfaces.

Modifications for First Aid Procedures:

Having individuals available to render first aid should it be needed in an office or field setting is an essential responsibility and remains a critical part of BC emergency response protocols. Under COVID-19 conditions this responsibility remains, however extra precautions need to be taken to help prevent the potential spread of COVID-19 between those that are receiving aid and those that are providing it when vaccination status of individuals is not always known.

Individuals providing and receiving first aid should wear face masks if they are available. However, providing life-saving medical assistance is the priority if masks are not available.

Use of disposable nitrile gloves and taking immediate action to decontaminate and sanitize after treatment is complete are also good practices when providing first aid treatment. Used PPE should be removed in such a way as to prevent contaminating yourself or others in the vicinity.

References to Additional BC Guidance Documents

Refer to these additional guidance documents, procedures and forms as referred to in this H&S Plan Addendum. These documents will be available on the BC Coronavirus Resource Page and/or the BC Health and Safety SharePoint pages. These documents are subject to change as additional guidance is issued by CDC, BCCDC, and WHO and reviewed and incorporated by BC's COVID-19 Preparedness & Response Team.

- ***COVID-19 General Travel SOP***
- ***COVID-19 Employee Temperature Monitoring Procedure***

Instructions: Where require by client or local regulation, BC personnel and subcontractors should review the questions each day and confirm that all statements are accurate for their personal situation before signing the document. (Note: use of the BC digital wellness screening app was discontinued March 14, 2022).

By signing below, I attest that:

- 1) I have been free of fever (100.4° F [38.0° C]) signs of a fever, and other COVID-19 symptoms for at least 24 hours, without the use of fever-reducing or other symptom-altering medicines (e.g. acetaminophen).

Most common symptoms

- Fever with temp > 100.4°F/38 °C
- Sore throat
- Dry cough
- Fatigue or tiredness
- Congestion or runny nose
- Nausea or vomiting

Less common symptoms

- Muscle or body aches and pains
- Diarrhea
- Conjunctivitis/Eye irritation
- Headache of unknown origin
- New loss of taste or smell
- Skin rash/discoloration of toes or fingers

Serious symptoms

- Shortness of breath /difficulty breathing
- Persistent chest pain or pressure
- New confusion or loss of speech/movement
- Bluish lips or face
- Difficulty waking or staying awake

- 2) To the best of my knowledge, I have not been in close contact* with someone diagnosed with COVID-19 or who are exhibiting any of the symptoms listed above (in the last 14 days).
- 3) If temperature monitoring is being required and based on site pre-entry temperature screening, my temperature is determined to be <100.4°F / 38°C. Document pass/fail status below.

*NOTE: "Close Contact" is defined as living in the same household or caring for someone who's infected, direct exposure from someone who's infected (e.g., being coughed/sneezed on), or being within 6 feet of a diagnosed or presumed infected person for a cumulative total of 15 or 30 minutes or more over a 24-hour period starting from 2 days before illness onset:

- **For Enclosed/Constrained Environments:** <6 feet for cumulative period of **15 minutes over 24-hours.**
- **For Open Air/Unconstrained Environments:** <6 feet for cumulative period of **30 minutes over 24-hours.**

[illegible]

COVID-19 H&S Plan Addendum

Version Management:

Version No.	Date	Name	Changes
1	3/21/20	M/Bixby/S. Everman/K. Hoff	Initial SOP
5	6/23/21	P.Basett	Update symptom list and wellness questions to include optional face mask if vaccinated; incorporate Appendix A as an attachment to the H&S addendum
6	10/27/21	M. Bixby	Rephrased requirements for face mask use scenarios to reflect current BC approach to field work involving populations with different vaccination status. Add comment on 5 to 7-day window for detection of new infections with Delta variants. Added comments about booster shots. Changed symptom free pretravel period from 24 to 48 hours. Added new CDC symptom (waking difficulty). Added language about vaccine effectiveness.
7	2/23/22	Edit: P. Bassett Review: M. Bixby	Remove "What is COVID" section;; add definition for "recently vaccinated"; update face mask requirements to remove mandates but retain CDC recommended face mask use. Added section on COVID-19 testing. Upgrade mask quality language.
8	3/15/22	M. Bixby	Removed references to the use of the BC Digital Wellness Screening App (a.k.a. Check-in app)

APPENDIX F-2

GENERIC COMMUNITY AIR MONITORING PLAN

Appendix 1A

New York State Department of Health Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.
4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed $150 \text{ mcg}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than $150 \text{ mcg}/\text{m}^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within $150 \text{ mcg}/\text{m}^3$ of the upwind level and in preventing visible dust migration.

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

December 2009

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions should also be pre-determined). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.
- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m³, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m³ or less at the monitoring point.
- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

Special Requirements for Indoor Work With Co-Located Residences or Facilities

Unless a self-contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated above under “Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures” except that in this instance “nearby/occupied structures” would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings, conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.

Appendix 1B

Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.
2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.
3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM₁₀) with the following minimum performance standards:
 - (a) Objects to be measured: Dust, mists or aerosols;
 - (b) Measurement Ranges: 0.001 to 400 mg/m³ (1 to 400,000 :ug/m³);
 - (c) Precision (2-sigma) at constant temperature: +/- 10 :g/m³ for one second averaging; and +/- 1.5 g/m³ for sixty second averaging;
 - (d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
 - (e) Resolution: 0.1% of reading or 1g/m³, whichever is larger;
 - (f) Particle Size Range of Maximum Response: 0.1-10;
 - (g) Total Number of Data Points in Memory: 10,000;
 - (h) Logged Data: Each data point with average concentration, time/date and data point number
 - (i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
 - (j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
 - (k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
 - (l) Operating Temperature: -10 to 50° C (14 to 122° F);
 - (m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.
4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.
5. The action level will be established at 150 ug/m³ (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m³, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m³ above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m³ continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM₁₀ at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

- (a) Applying water on haul roads;
- (b) Wetting equipment and excavation faces;
- (c) Spraying water on buckets during excavation and dumping;
- (d) Hauling materials in properly tarped or watertight containers;
- (e) Restricting vehicle speeds to 10 mph;
- (f) Covering excavated areas and material after excavation activity ceases; and
- (g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m³ action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

APPENDIX G

GENERIC QUALITY ASSURANCE PROJECT PLAN

**GENERIC
QUALITY ASSURANCE PROJECT PLAN
FOR
SITE INVESTIGATIONS
AT NON-OWNED FORMER MGP SITES**

Prepared for:
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NOVEMBER 2002

Reviewed and Approved by: _____
(Project Quality Assurance Manager) (Signature) (Date)

Site Specific
Revisions Attached: Supplement No. _____ Date _____

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Generic QAPP for Site Investigations at Manufactured Gas Plant Sites

1.0 GENERAL

This Generic Quality Assurance Project Plan (QAPP) has been prepared to specify procedures that will provide data of known, documented quality, and which will be legally defensible, should the need exist. This document specifically supplements the Generic Field Sampling Plan (FSP), also attached as an appendix to the Site-Specific Work Plan. To the extent discrepancies exist between this Generic QAPP and the Site-Specific Work Plan, the Site-Specific Work Plan shall control.

2.0 PROJECT DESCRIPTION

The project sites are Former Non-owned Manufactured Gas Plant (MGP) sites. The purpose of the investigations is to gather sufficient data to enable the New York State Department of Environmental Conservation (NYSDEC) and Niagara Mohawk, a National Grid Company (NM) to characterize chemical substances which are or may be present at the Sites and to enable the NYSDEC and NM to determine whether such substances pose a significant threat to public health or the environment.

The data collected as a result of these investigations will be used to support the Site Characterizations and Remedial Investigation/Feasibility Studies (RI/FS) as described in the Site-Specific Work Plans. The types, numbers, and locations of environmental samples to be collected are also described in the Site-Specific Work Plans. Field procedures for all environmental sampling activities are detailed in the FSP.

3.0 PROJECT ORGANIZATION

The project organization is described in detail in the Site-Specific Work Plan. The project organization describes the relationship between the NM Project Manager, NYSDEC Project Manager, NM's Engineering Consultant, and subcontractors (e.g. laboratories, data validators, drillers, etc.).

For the purpose of quality control, the Engineering Consultant's Project Quality Assurance Manager (PQAM) will be responsible for review of data upon receipt from the analytical laboratory. The PQAM will assure that data validation screening is performed by trained and experienced data validators using the applicable criteria specified in the NYSDEC 2001 Analytical Services Protocol (ASP). For the purposes of this document, all references to ASP indicate the 2001 NYSDEC Analytical Services Protocol. The specific requirements for data validation screening are given in Section 9.3. The PQAM will be responsible for ensuring that all analytical data are in conformance with requirements of this QAPP.

4.0 QA/QC OBJECTIVES FOR MEASUREMENT OF DATA

The overall quality assurance (QA) objective for the project is to develop and implement procedures which will provide data of known, documented quality. Field and laboratory quality assurance/quality control (QA/QC) requirements defined in the NYSDEC ASP and other applicable guidelines ensure acceptable levels of data quality will be maintained throughout the sampling and analysis program.

The QA/QC objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. The data reduction, validation, and reporting scheme is presented in Figure 1. The quality assurance samples to be collected (type and frequency of collection) are specified in the Site-Specific Work Plans.

4.1 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), and relative range are common. For this project, precision will be evaluated by recording duplicate measurements of the same parameter on similar sample aliquots under the same conditions and calculating the relative percent difference (RPD) between the values. The formula for calculating RPD is presented in Section 13.2.

RPDs can only be calculated when the duplicate samples both contain detectable concentrations of the analyte. If an analyte is considered not detected at the detection limit, then RPD cannot be calculated. Instead, the results of the analysis of the two-spiked laboratory samples will be used to determine precision.

Measurement data for this project will include field data as well as laboratory analytical data. Laboratory precision will be performed according to the requirements described in the associated analytical methods. The field measurement data may include immunoassay polycyclic aromatic hydrocarbon (PAH) and/or polychlorinated biphenyl (PCB) screening, pH, conductivity, temperature, turbidity, organic vapor readings, and water level measurements. The objective for precision of field data collection methods is to take replicate (minimum of two for every 20 samples) measurements for field parameters to determine the reproducibility of the measurements.

Precision of the immunoassay screening will be evaluated by the field analysis of replicate samples as equivalent levels of PAHs/PCBs. As the screening is not quantitative (i.e., the screening determines if the constituents are present above or below standard values and does not provide a numeric result), RPDs cannot be calculated on the field-analyzed samples. Therefore, measurement of equivalent levels of constituent (i.e., detected below the same standard or within the same range of two standards) will be considered as denoted precision of the screening test.

For the pH meter, precision will be tested by multiple readings in the medium of concern. Consecutive

readings should agree within 0.1 pH units after the instrument has been field calibrated with standard buffers before each use. The thermometer will be visually inspected prior to each use to ensure its condition is satisfactory. Consecutive measurements of a given sample should agree to within 1°Celsius. After calibration, the conductivity meter will be tested for precision at $\pm 1\%$ of full-scale, depending on the meter/scale. The organic vapors will be measured using a Photovac Microtip (or equivalent) photoionization detector (PID). Daily background and upwind readings of drilling and sampling activities will be measured prior to commencing work and at periodic intervals throughout each day's activities. The natural variation/fluctuation in measurements at background or upwind locations will be used for baseline background values, and the variability will be noted. Water level indicator readings will be precise within 0.01 feet for duplicate measurements or additional water level measurements will be collected to determine whether the difference is due to operator or instrument error. Turbidity measurements will be calibrated to a precision of $\pm 2\%$ nephelometric turbidity units (NTUs).

4.2 Accuracy

Accuracy is a measure of the difference between a measured value and the "true" or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity, which is recovered, or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes that are close to the detection limits are less accurate because they are affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument or other variables and thus will be more accurate.

The accuracy of laboratory-measured data will be evaluated by determining the percent recovery of both matrix and blank spike samples as described in Section 13.1. For the measurement of organics by gas chromatography (GC) or GC/mass spectroscopy (MS), the recovery of a surrogate spiked into each sample, blank, and standard will also be used to assess accuracy.

Accuracy between the immunoassay screening and the laboratory analytical results will be evaluated by the confirmatory testing of 10 percent (i.e., one in ten) of the environmental samples at the off-site laboratory. The rate of potential false positives and negatives should be less than 15 percent. Screening samples will not be spiked in the field by the addition of known parameter concentrations. However, the confirmatory samples sent to the off-site laboratory will undergo surrogate spiking and recovery evaluation and, to the extent possible, may be chosen as the site-specific matrix spike sample(s) for additional accuracy determination.

The objective for accuracy of the other field measurements is to achieve and maintain factory equipment specifications for the field equipment. Field measurements cannot be assessed for accuracy by spiking the medium with the analytical parameter and measuring the increase in response;

therefore, these instruments can only be assessed for accuracy by the response to a known sample (such as a calibration standard) used to standardize them. The pH meter, conductivity meter, and turbidity meter are calibrated with solutions traceable to the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards).

All volatile organic detectors (such as the PID) will be calibrated to an appropriate standard daily prior to use.

4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, or analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the FSP. Laboratory sample containers will be thoroughly cleaned in accordance with procedures outlined in Section 5.2. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated through the analysis of field duplicate samples, coded to ensure the samples are treated and analyzed as separate samples. The analytical laboratory will make every reasonable effort to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received. Many means of homogenization expose the sample to significant risk of contamination or loss through volatilization, and these should be avoided if possible.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank/duplicate and chain-of-custody procedures are presented in Sections 5.3 and 6.1.

4.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. The QC objective for completeness is generation of valid data for 100 percent of the analysis requested. Any data deficiencies and their impact on project goals will be evaluated during data validation and discussed in the Data Usability Summary Report (DUSR) (see Section 9.3.2).

4.5 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Ensuring traceability of all analytical standards and/or source materials to USEPA or NIST;
- Verifying all calibrations with an independently prepared standard from a source other than that used for calibration;
- Using standard reporting units and reporting formats including the reporting of QC data;
- The validation of all analytical results, including the use of data qualifiers in all cases where appropriate; and
- The requirement that all validated flags be used any time an analytical result is used for any purpose whatsoever.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

5.0 SAMPLING PROCEDURES

5.1 Sampling Program

The objective of the sampling program is to provide current data concerning the presence and nature and extent of contamination of groundwater, surface water, soils (surface and subsurface), and/or sediment. Sampling and analysis may include as identified in the Site-Specific Work Plan:

- groundwater samples
- surface water samples
- sediment samples
- surface and/or subsurface soil samples
- air samples

5.2 Sampling Procedures and Handling

Sample Container Preparation

Sample containers will be properly washed and decontaminated by the factory or laboratory prior to use. All preservatives will be added to containers prior to shipment by the laboratory. The types of containers and preservation techniques are shown in Table 1. Records of the sources of bottles and preservatives will be kept by the analytical laboratory.

Methods of Sampling

As a minimum, sampling procedures will be in accordance with the most recent NYSDEC or USEPA guidelines and/or regulations, as appropriate. Alternate techniques will be utilized when such guidelines and/or regulations are inappropriate or non-existent. Alternate techniques will be implemented only after consultation with NYSDEC, whenever possible.

Referenced sampling procedures are listed below. All procedures will be the latest in effect as of the date of this Generic QAPP.

- USEPA - 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes"
- National Water Well Association - "Manual of Ground-water Sampling Procedures"
- USEPA - 600/4-83-040, "Characterization of Hazardous Waste Sites - a Methods Manual: Volume II. Available Sampling Methods"
- USEPA - OSWER - 9950.1 "RCRA Ground-water Monitoring Technical Enforcement Guidance Document"
- USEPA - 540/S-95/504, "Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures"

- NYSDEC – “Technical and Administrative Guidance Memoranda” (TAGMs)

All sampling methods are explained in detail in the FSP.

5.3 Quality Assurance Samples

Field Quality Control Samples

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. The blanks will include:

Trip Blank - A trip blank will be prepared by the laboratory, and will consist of 40-ml volatile organic analysis (VOA) vials containing distilled, deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for which analysis for Target Compound List (TCL) volatiles or benzene, toluene, ethylbenzene and total xylenes (BTEX) is planned. The trip blank will be analyzed for TCL volatile organic compounds or BTEX to assess any contamination introduced as a result of sampling and transport, , handling and storage.

Equipment Blank - Equipment blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix as specified in the Site-Specific Work Plan. Equipment blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory, which has passed through or over the sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to collecting a sample. The equipment blanks will be analyzed for the same parameters as the matrix being sampled.

In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike (MS)/matrix spike duplicates (MSD)/matrix duplicates (MD).

The duplicates will consist of:

Field Duplicate - To determine the reproducibility and homogeneity of samples, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise. The frequency of collection of these samples is one per 20 field samples as specified in the Site-Specific Work Plans. The criteria for assessing coded field duplicates are given in Section 6.0.

Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate (MS/MSD/MD) - MS/MSD/MD samples (MSD for organics; MD for inorganics) will be collected at a frequency of one pair per 20 field samples per seven day sample delivery group (SDG). The reproducibility and homogeneity of the samples can be assessed by determining the

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RPD for both spike and non-spike compounds as described in Section 13.0. The MS, MSD, and MD samples should be Site-Specific, unless otherwise authorized by the Engineering Consultant's Project Manager and/or PQAM after consultation with NM and NYSDEC personnel whenever possible.

6.0 SAMPLE TRACKING AND CUSTODY

Sample chain-of-custody (COC) will be initiated by the laboratory with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling the samples will be minimized.

In-situ or on-site monitoring data will be controlled and entered in permanent logbooks. Personnel involved in the COC and transfer of samples will be trained on the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity will be provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 2. A sample will be considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with custody seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

6.1 Field Sample Custody

A COC record will accompany the sample from time of collection to receipt by the analytical laboratory. If samples are split and sent to different laboratories, COC records will be sent with each sample. Figure 3 is a typical example of a chain-of-custody record. The "remarks" column will be used to record specific considerations associated with sample acquisition such as: sample type, container type, sample preservation methods, and analyses to be performed. Two copies of this record will accompany the samples to the laboratory. The laboratory will maintain one file copy, and the completed original will be returned to the Engineering Consultant's Project Manager.

Individual sample containers, provided by the laboratory, will be used for shipping/couriering samples. The shipping containers are insulated, and ice will be used to maintain samples at approximately four degrees Celsius until samples are returned and in the custody of the laboratory. All sample bottles within each shipping container will be individually labeled and controlled.

Each sample shipping container will be assigned a unique identification number by the laboratory, and will be marked with indelible ink on the outside of the shipping container. This number will be recorded on the COC record. The field sampler will indicate each individual sample designation/location number in the space provided on the appropriate COC form for each sample collected. The shipping container will then be closed, and a seal provided by the laboratory affixed to the latch. This seal must be broken to open the container. Tampering may be indicated if the seal

is broken before receipt at the laboratory. The laboratory will contact the FOL or Engineering Consultant's Project Manager, and the associated samples will not be analyzed if tampering is apparent.

6.2 Laboratory Sample Custody

The FOL will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The laboratory sample program will meet the following criteria:

- The laboratory will designate a sample custodian who is responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of any discrepancy in documentation, the laboratory will immediately contact the Engineering Consultant's Project Manager and/or PQAM as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. That assessment will be recorded as part of the incoming COC procedure.
- The samples will be stored in a secured area at a temperature of approximately four degrees Celsius until analyses are to commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking form will accompany the laboratory report and will become a permanent part of the project records.

6.3 Sample Tracking System

A sample tracking system will be implemented to monitor the status of sampling events and laboratory analysis of samples. Sample numbers, types, analytical parameters, sampling dates, and sample delivery group (SDG) designations for samples, and required due dates for receipt of analytical results will be entered into the system. The Engineering Consultant's Project Manager will use the tracking system to monitor the project sampling schedules and the status of analytical reports, and to implement any penalty clauses for late delivery per standard laboratory subcontracts when necessary.

A description of the sample tracking system follows:

1. For each day that samples are collected, the Field Operations Lead (FOL) or designee will complete a COC form (Figure 3) and a Daily Status and Monitoring Report (Figure 4) listing all appropriate samples.
2. The FOL or designee will retain the client copy of the COC, and forward the laboratory copy of the COC with the sample shipment.
3. The FOL or designee will fax copies of the completed COC form and Daily Status and Monitoring Report to the Engineering Consultant's PM. The Engineering Consultant's PM or a designated employee will confirm sample shipment with the laboratory and resolve any sample transfer issues.
4. The status of analytical results will be tracked by the Engineering Consultant's PM or designee using the information provided on the completed COC form and Daily Status and Monitoring Report. The information shall be summarized in a computerized database, as warranted.

Upon receipt of the analytical results from the laboratory, the Engineering Consultant's PM or designee will review the data package for completeness and contract compliance. The Engineering Consultant's PM will then forward the result package to the data validator for validation. The data validator shall be required to submit a complete set of validated data to the Engineering Consultant's PM within 60 days of receipt of the data package report.

The Engineering Consultant's Project Manager or a designated representative will maintain day-to-day contact with the laboratory concerning specific samples and analyses directly or by assignment.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 Field Instrumentation Calibration

The FOL will be responsible for ensuring that instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to their specific calibration protocols/procedures.

All field measurement instruments must be calibrated according to the manufacturer's instructions prior to the commencement of the day's activities. Exceptions to this requirement shall be permitted only for instruments that have fixed calibrations pre-set by the equipment manufacturer. Calibration information shall be documented on instrument calibration and maintenance log sheets or in a designated field logbook. The calibration information (log sheet or logbook) shall be maintained at the site during the on-site investigation and, once the field work is completed, shall be placed in the Engineering Consultant's project files. Information to be recorded includes the date, the operator, and the calibration standards (concentration, manufacturer, lot number, expiration date, etc.). All project personnel using measuring equipment or instruments in the field shall be trained in the calibration and usage of the equipment, and are personally responsible for ensuring that the equipment has been properly calibrated prior to its use.

In addition, all field instruments must undergo response verification checks at the end of the day's activities and at any other time that the user suspects or detects anomalies in the data being generated.

Verification checks may also be performed at the request of NM or NYSDEC representatives. The checks consist of exposing the instrument to a known source of analyte (e.g., the calibration solution), and verifying a response. If an unacceptable instrument response is obtained during the check (i.e., not within specifications), the data shall be labeled suspect, the problem documented in the site logbook, and appropriate corrective action taken.

Any equipment found to be out of calibration shall be re-calibrated. When instrumentation is found to be out of calibration or damaged, an evaluation shall be made to ascertain the validity of previous test results since the last calibration check. If it is necessary to ensure the acceptability of suspect items, the originally required tests shall be repeated (if possible), using properly calibrated equipment, to acquire replacement data for the measurement in question.

Any instrument consistently found to be out of calibration shall be repaired or replaced within 24 hours or field work will be terminated until the malfunctioning equipment is repaired/replaced.

7.2 Laboratory Instrumentation Calibration

Personnel at the laboratory will be responsible for ensuring that analytical instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to specific protocols/procedures.

Off-site laboratory equipment shall be calibrated using certified/nationally recognized standards and according to the applicable methodologies and the laboratory Standard Operating Procedures (SOPs).

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In addition, these methods/procedures specify the appropriate operations to follow during calibration or when any instrument is found to be out of calibration.

8.0 ANALYTICAL PROCEDURES

All off-site laboratory samples will be analyzed according to the methods provided in Exhibit D of the NYSDEC ASP. QA/QC procedures given in Exhibit E and I of the ASP will be followed. Regardless of the method used, all analytical and extraction holding times must meet the NYSDEC ASP requirements for that analytical group (i.e., volatile analyses, including BTEX, have a holding time of seven days, if unpreserved). Holding times will be calculated from verified time of sample receipt at the laboratory. For NYSDEC ASP, samples must be received at the laboratory within 48 hours of sample collection. The analytical laboratory chosen for the project will be certified, and must maintain certification, under the New York State Department of Health's Environmental Laboratory Approval Program for analyses of solid and hazardous waste. The breakdown of investigative samples is detailed in the Site-Specific Work Plan. Laboratory analytical methods and quantitation limits are presented in Tables 2 and 3 of this Generic QAPP. The method detection limits (MDLs) for the analytes will be specified by the laboratory selected for the project based on its most recent MDL studies, and subject to approval by the NYSDEC.

Field screening samples will be analyzed according to the NYSDEC ASP and the manufacturer's instructions. Unless site-specific requirements dictate a change in concentration limits (which would be explained within the Site-Specific Work Plan), the standard levels for the PAH and PCB screening will be 1 ppm and 10 ppm. The test system user shall be technically qualified individual who has received training in the immunoassay analysis requirements, procedures and potential risks prior to field screening of samples. Use of the field screening test kits will only occur in a controlled environment, following the storage and handling procedures outlined in the NYSDEC ASP and the manufacturer's instructions. Additional technical information on the field screening testing are presented in Attachments 1 and 2.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the ASP.

The data package provided by the laboratory will contain all items specified in the ASP, as appropriate to the analyses performed. Category B reporting will be used.

9.1 Chain-of-Custody Records

Completed copies of the COC records accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the report of analytical testing.

9.2 Data Handling

One complete copy and one additional copy of the analytical data summary report will be provided by the laboratory. One set of the analytical data will be forwarded directly to the data validator by the laboratory. The Engineering Consultant's Project Manager will immediately arrange for filing of the complete package, after the QA/QC reviewer checks the package to ensure all deliverables have been

provided. The second data summary report will be used to generate summary tables. These tables will form the foundation of a working database for assessment of the site contamination condition.

The Engineering Consultant's Project Manager will maintain close contact with the QA/QC reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA/QC review has been completed, the Engineering Consultant's Project Manager may direct the team leaders or others to initiate and finalize the analytical data assessment.

9.3 Data Validation

9.3.1 Full Data Validation

Data validation is a basic step in the control and processing of the project data generated by the laboratory. The data validation process will consist of a systematic review of the analytical results and QC documentation, and will be performed in accordance with the guidelines identified in Section 9.3.1. All off-site laboratory data will undergo full validation, unless otherwise stated in the Site-Specific Work Plan. On the basis of this review, the data validator will make judgments and express concerns and comments on the quality and limitations of specific data, as well as on the validity of the overall data package. The data validator will prepare documentation of his or her review and conclusions in a Data Usability Summary Report (DUSR; see Section 9.3.2).

The data validator will inform the Engineering Consultant's Project Manager of data quality and limitations, and assist the Project Manager in interacting with the laboratory to correct data omissions and deficiencies. The laboratory may be required to rerun or resubmit data depending on the extent of the deficiencies, and their importance in meeting the data quality objectives within the overall context of the project. The validated laboratory data will be reduced into a computerized tabulation which will be suitable for inclusion in the Site Characterization and RI Reports and will be designed to facilitate comparison and evaluation of the data. The data tabulations will be sorted by classes of constituents and by sample matrix. Each individual table will present the following information:

- Sample matrix, designations, and locations;
- Sample dates;
- Constituents for which positive results were obtained;
- Reported constituent concentrations in the field and/or trip blanks associated with the samples;
- Constituent concentration units;
- Name and location of laboratory which performed the analyses;
- Data qualifiers provided by the laboratory; and
- Data qualifiers and comments provided by the data validator, if any.

9.3.1 Data Usability Summary Report (DUSR)

A Data Usability Summary Report (DUSR) will be prepared after reviewing and evaluating the analytical data. The parameters to be evaluated in reference to compliance with the analytical method protocols includes all sample chain-of-custody forms, holding times, raw data (instrument print out data and chromatograms), calibrations, blanks, spikes, controls, surrogate recoveries, duplicates and sample data. If available, the field sampling notes should also be reviewed and any quality control problems should be evaluated as to their effect on the usability of the sample data.

The DUSR will describe the samples and analysis parameters reviewed. Data deficiencies, analytical method protocol deviations and quality control problems will be described and their effect on the data will be discussed in the DUSR.

Resampling/reanalysis recommendations, if applicable, will be made. Data qualifications are documented for each sample analyte following the NYSDEC ASP guidelines.

This work will be performed by trained and experienced data validators who meet the NYSDEC

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approval criteria. The Environmental Scientist preparing the DUSR must submit a resume to the NYSDEC Quality Assurance Unit documenting relevant experience in environmental sampling and analysis methods and data review and documentation of a Bachelors Degree in Natural Science or Engineering. The results of the data validation screening (i.e. missed holding times or data rejected due to blank contamination) will be incorporated into the data summary tables used in the final investigative report. The DUSR identifies data gaps caused by non-compliant or rejected data, and will indicate what steps have been or will be taken to fill these gaps.

10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

10.1 Quality Assurance Batching

Each set of samples will be analyzed concurrently with calibration standards, method blanks, MS, MSD or MD, and QC check samples (if required by the protocol). The MS/MSD/MD samples will be designated by the field personnel. If no MS/MSD/MD samples have been designated, then the laboratory must contact the Project Quality Assurance Officer (PQAO) or Engineering Consultant's Project Manager for corrective action.

10.2 Organic Standards and Surrogates

All standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or earlier based upon data indicating deterioration.

10.3 Laboratory Quality Control Samples

The quality control samples included are detailed below.

Method Blanks/Preparation Blanks: Analyses for organic compounds (method blank) and inorganics (preparation blank) include a blank analysis of the laboratory reagent water. The blank is analyzed with each set of samples or more often as required to verify that contamination has not occurred during the analytical process. The concentration of target compounds in the blanks must be less than or equal to the method detection limits specified in the ASP for the selected method of analysis.

Matrix Spike/Matrix Spike Duplicate Analysis - This analysis is used to determine the effects of matrix interference on analytical results. Spikes of analytes are added to aliquots of sample matrix in the manner specified in the ASP. Selected samples are spiked to determine accuracy as a percentage recovery of the analyte from the sample matrix and precision as RPD between the MS and MSD samples. A matrix duplicate is prepared in the same manner as the matrix spike sample.

Analytical Duplicate Samples - Replicate samples are aliquots of a single sample that are split on arrival at the laboratory, or upon analysis. Significant differences between two replicates, split in a controlled laboratory environment, will result in flagging the affected analytical results.

Surrogate Spike Analyses - Surrogate spike analyses are used to determine the efficiency of recovery of organic analytes in the sample preparations and analyses. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method.

Laboratory Control Sample/ (Spike Blank) - For each method which requires a laboratory control sample (LCS) or spike blank, a LCS spike blank will be prepared with each quality control batch and analyzed according to criteria specified in the ASP. These samples support an assessment of the ability of the analytical procedure to generate a correct result without matrix effects or interference affecting the analysis.

11.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

Quality assurance audits may be performed by the Project Quality Assurance Manager (PQAM) or personnel designated by the PQAM. The PQAM and his or her designees function as an independent body and report directly to Engineering Consultant's quality assurance management. The PQAM may plan, schedule, and approve system and performance audits based upon the Engineering Consultant's procedure customized to the project requirements. These audits may be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). At times, the PQAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits.

Formal audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by lead auditors after gathering and evaluating all resultant data. Items, activities, and documents determined by lead auditors to be in noncompliance will be identified at exit interviews conducted with the involved management. Noncompliances will be logged, documented, and controlled through audit findings which are attached to and are a part of the integral audit report. These audit finding forms will then be directed to management to satisfactorily resolve the noncompliance in a specified and timely manner. All audit checklists, audit reports, audit findings, and acceptable resolutions must be approved by the PQAM prior to issue. QA verification of acceptable resolutions will be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the PQAM will close out the audit report and findings.

It is the Engineering Consultant's Project Manager's overall responsibility to verify that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Engineering Consultant's Project Manager within 15 days of completion of the audit. Serious deficiencies must be reported to the Engineering Consultant's Project Manager within 24 hours.

Serious deficiencies identified during an audit will be reported to NM and NYSDEC as part of the DUSR or Site investigation and/or RI Reports.

11.1 System Audits

System audits, performed by the PQAM or designated auditors, may encompass evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Engineering Consultant's Project Manager requests the PQAM to perform unscheduled audits, these activities will be instituted.

11.2 Performance Audits

In accordance with the requirements for NYSDOH ELAP CLP certification, the laboratory will participate in all performance evaluation testing.

Also, one field audit may be performed by the PQAM or designated auditor during collection of the field samples to verify that field samplers are following established sampling procedures. Performance of a field audit will be based on the type of investigation activities being performed, the length of the field project, and any available information concerning prior inspections of the project or sampling team. The Site-Specific Work Plan will provide details on the performance of a field audit.

12.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

12.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators. Analytical instruments will be serviced at intervals recommended by the manufacturer. An instrument repair/maintenance log book will be kept for each instrument, and this log will be available on-site during field activities and, at the completion of the investigation, be placed in the project files. Entries include the date of service, type of problem encountered, corrective action taken, and initials and affiliation of the person providing the service.

The instrument use log book will be monitored by the analysts to detect any degradation of instrument performance. Changes in response factors or sensitivity are used as indications of potential problems. These are brought to the attention of the laboratory supervisor and preventive maintenance or service is scheduled to minimize down time. Back-up instrumentation and an inventory of critical spare parts are maintained to minimize delays in completion of analyses.

Use of equipment in need of repair will not be allowed, and field work will be terminated until the malfunction is repaired or the instrument replaced.

12.2 Schedules

Written procedures, where applicable, will identify the schedule for servicing critical items in order to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange any necessary and prompt service as required. Service to the equipment, instruments, tools, gauges, etc. shall be performed by qualified personnel.

12.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools, and gauges are used at the sites. The Engineering Consultant's Project Manager or the PQAM may audit these records to verify complete adherence to these procedures.

12.4 Spare Parts

Where appropriate, a list of critical spare parts will be identified by the operator in consultation with the equipment manufacturer. These spare parts will be stored for availability and use in order to reduce the downtime. In lieu of maintaining an inventory of spare parts, a service contract for rapid instrument repair or backup instruments will be available.

13.0 ASSESSMENT PROCEDURES FOR DATA ACCEPTABILITY

Procedures used to assess data precision and accuracy will be in accordance with the appropriate laboratory method, and as periodically updated.

13.1 Accuracy

The percent recovery is calculated as below:

$$\% = \frac{S_s - S_o}{S} \times 100$$

S_o = The background value, i.e.; the value obtained by analyzing the sample

S = Concentration of the spike added to the sample

S_s = Value obtained by analyzing the sample with the spike added

$\%$ = Percent Recovery

13.2 Precision

The relative percent difference (RPD) is calculated as below:

$$RPD = \frac{|V_1 - V_2|}{0.5 (V_1 + V_2)} \times 100$$

V_1, V_2 = The two values obtained by analyzing the duplicate samples

13.3 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the total amount expected to be obtained under ideal conditions. A target of 100 percent completeness, calculated for each analysis method, has been established as the overall project objective.

$$PC = \frac{NA}{NI} \times 100$$

where:

PC = Percent completeness

NA = Actual number of valid analytical results obtained

NI = Theoretical number of results obtainable under ideal conditions

14.0 CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted on-site, at the laboratory, or at a subcontractor location, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the FOL, Engineering Consultant's Project Manager, and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action. All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality.

At a minimum, corrective actions may be initiated:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined deficient
- When equipment or instrumentation is found faulty
- When samples and test results are questionably traceable
- When quality assurance requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/inter-field comparison studies
- As required by NM
- As required by NYSDEC ASP, 2001

Procedure Description

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities.

Work may be audited at Engineering Consultant's office, Site, laboratory, and subcontractor locations by the PQAM and/or designated auditor. Items, activities, or documents ascertained to be in noncompliance with quality assurance requirements will be documented and corrective actions mandated through audit finding sheets attached to the audit report. Audit findings are logged,

maintained, and controlled by the PQAM (Section 11.0).

Technicians assigned quality assurance functions will also control noncompliance corrective actions by having the responsibility of issuing and controlling the appropriate Corrective Action Request Form (Figure 5). All project personnel may identify a noncompliance; however, the technician is responsible for documenting, numbering, logging, and verifying the closeout action. It is the Engineering Consultant's Project Manager's responsibility to verify that all recommended corrective actions are produced, accepted, and received in a timely manner.

The Corrective Action Request (CAR) identifies the adverse condition, reference document(s), and recommended corrective action(s) to be administered. The issued CAR is directed to the responsible manager in charge of the item or activity for action. The individual to whom the CAR is addressed returns the requested response promptly to the technician in charge, affixing his signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The technician maintains the log for status control of CARs and responses, confirms the adequacy of the intended corrective action, and verifies its implementation. The technician will issue and distribute CARs to specified personnel, including the originator, responsible project management involved with the condition, the Engineering Consultant's Project Manager, involved subcontractor, and the FOL, at a minimum. CARs are transmitted to the project file for the records.

15.0 QUALITY ASSURANCE REPORTS

Quality assurance reports to management may consist of the reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and the data validation report.

At the end of the project, the PQAM may submit a lessons learned report to the Engineering Consultant's Project Manager which will discuss the QA activities. That report may include discussions of any conditions adverse or potentially adverse to quality, such as responses to the findings of any field or laboratory audits; any field, laboratory, or sample conditions which necessitated a departure from the methods or procedures specified in this QAPP; field sampling errors; and any missed holding times or problems with laboratory QC acceptance criteria; and the associated corrective actions undertaken. This report shall not preclude immediate notification to project management of such problems when timely notice can reduce the loss or potential loss of quality, time, effort, or expense.

These reports, if prepared, shall be reviewed by the Engineering Consultant's Project Manager for completeness and the appropriateness of any corrective actions, and they shall be retained in the project files.

In the final investigative report, laboratory and field QC data will be presented, including a summary of QA activities and any problems and/or comments associated with the analytical and sampling effort. Any corrective actions taken in the field, results of any audits, and any modifications to laboratory protocols will be discussed.

Attachment 1

NYSDEC ASP Methods 4035 (PAHs) and 4020 (PCBs)

Attachment 2

Field PAH and PCB Soil Test Technical Guides and Test Kit Instructions

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ)
LIMITS¹

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL Volatile Organic Compounds (by 2001-1)		
Acetone	10	10
Benzene	10	10
Bromodichloromethane	10	10
Bromoform	10	10
Bromomethane	10	10
2-Butanone	10	10
Carbon disulfide	10	10
Carbon tetrachloride	10	10
Chlorobenzene	10	10
Chloroethane	10	10
Chloroform	10	10
Chloromethane	10	10
Dibromochloromethane	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethane	10	10
1,1-Dichloroethene	10	10
1,2-Dichloroethene (cis and trans)	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
trans-1,3-Dichloropropene	10	10
Ethylbenzene	10	10
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Methylene chloride	10	10
Styrene	10	10
1,1,2,2-Tetrachloroethane	10	10
Tetrachloroethene	10	10
Toluene	10	10
1,1,1-Trichloroethane	10	10
1,1,2-Trichloroethane	10	10
Trichloroethene	10	10
Vinyl chloride	10	10
Total Xylenes	10	10

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS¹

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2)		
Base/Neutral Extractables		
Acenaphthene	10	330
Acenaphthylene	10	330
Anthracene	10	330
Benzo(a)anthracene	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(g,h,i)perylene	10	330
Benzo(a)pyrene	10	330
bis(2-Chloroethoxy)methane	10	330
bis(2-Chloroethyl)ether	10	330
bis(2-ethylhexyl)phthalate	10	330
4-Bromophenyl phenyl ether	10	330
Butyl benzyl phthalate	10	330
Carbazole	10	330
4-Chloroaniline	10	330
2-Chloronaphthalene	10	330
4-Chlorophenyl phenyl ether	10	330
Chrysene	10	330
Dibenz(a,h)anthracene	10	330
Dibenzofuran	10	330
Di-n-butylphthalate	10	330
1,2-Dichlorobenzene	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
3,3'-Dichlorobenzidine	10	330
Diethyl phthalate	10	330
Dimethyl phthalate	10	330
2,4-Dinitrotoluene	10	330

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS¹

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.)		
2,6-Dinitrotoluene	10	330
Di-n-octylphthalate	10	330
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadiene	10	330
Hexachloroethane	10	330
Indeno(1,2,3-cd)pyrene	10	330
Isophorone	10	330
2-methyl Naphthalene	10	330
Naphthalene	10	330
2-Nitroaniline	25	800
3-Nitroaniline	25	800
4-Nitroaniline	25	800
Nitrobenzene	10	330
N-Nitroso-diphenylamine	10	330
N-Nitroso-dipropylamine	10	330
2,2' Oxybis(1-chloropropane)	10	330
Phenanthrene	10	330
Pyrene	10	330
1,2,4-Trichlorobenzene	10	330

NOTES

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2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS¹

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.)		
Acid Extractables (cont.)		
4-Chloro-3-methylphenol	10	330
2-Chlorophenol	10	330
2,4-Dichlorophenol	10	330
2,4-Dimethylphenol	10	330
4,6-Dinitro-2-methylphenol	25	800
2,4-Dinitrophenol	25	800
2-Methylphenol	10	330
4-Methylphenol	10	330
2-Nitrophenol	10	330
4-Nitrophenol	25	800
Pentachlorophenol	25	800
Phenol	10	330
2,4,5-Trichlorophenol	25	800
2,4,6-Trichlorophenol	10	330
NYSDEC ASP TCL Pesticides and PCBs (by 2001-3)		
Aldrin	0.05	1.7
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Chlordane (alpha &/or gamma)	0.05	1.7
4,4'-DDD	0.10	3.3
4,4'-DDE	0.10	3.3
4,4'-DDT	0.10	3.3
Dieldrin	0.10	3.3
Endosulfan I	0.05	1.7
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3

NOTES

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TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS¹

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Pesticides and PCBs (by 2001-3, Cont.)		
Endrin	0.10	3.3
Endrin Aldehyde	0.10	3.3
Endrin Ketone	0.10	3.3
Heptachlor	0.05	1.7
Heptachlor Epoxide	0.05	1.7
Methoxychlor	0.50	17.0
Toxaphene	5.0	170.0
Aroclor-1016	1.0	33.0
Aroclor-1221	2.0	67.0
Aroclor-1232	1.0	33.0
Aroclor-1242	1.0	33.0
Aroclor-1248	1.0	33.0
Aroclor-1254	1.0	33.0
Aroclor-1260	1.0	33.0
NYSDEC ASP TAL Metals and Cyanide (by CLP-M)		
Aluminum	200	
Antimony	60	
Arsenic	10	
Barium	200	
Beryllium	5	
Cadmium	5	
Calcium	5000	
Chromium	10	
Cobalt	50	
Copper	25	
Iron	100	
Lead	3	
Magnesium	5000	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

**TABLE 3 (Cont'd.)
TARGET ANALYTES AND CRQ LIMITS¹**

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TAL Metals and Cyanide (by CLP-M) (Cont.)		
Manganese	15	
Mercury	0.2	
Nickel	40	
Potassium	5000	
Selenium	5	
Silver	10	
Sodium	5000	
Thallium	10	
Vanadium	50	
Zinc	20	
Cyanide	10	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

These CRQLs are the instrument detection limits obtained in pure water that must be met using the procedure in Exhibit E. The quantitation limits for samples may be considerably higher depending on the sample matrix.

TABLE 1
SAMPLE CONTAINERIZATION

Analysis	Bottle Type	Preservation ¹	Holding Time ²
Aqueous Samples			
Volatile Organics (BTEX)	40 ml glass vial with Teflon-lined septa	Cool to 4°C	7 days
PCBs/Pesticides	1000 ml amber glass	Cool to 4°C	5 days*
Semivolatile Organics (PAHs)	1000 ml amber glass	Cool to 4°C	5 days*
Metals	1000 ml polyethylene	HNO ₃ to pH <2	6 months (Mercury 26 days)
Cyanide	1000 ml polyethylene	NaOH to pH >12	12 days
Soil & Sediment Samples			
Volatile Organics (BTEX)	Wide-mouth glass w/ teflon-lined septa ³	Cool to 4°C	7 days
Semivolatile Organics (PAHs)	Wide-mouth glass w/ teflon cap ³	Cool to 4°C	5 days*
Pesticide/PCBs	Wide-mouth glass w/ teflon cap ³	Cool to 4°C	5 days*
Metals, Cyanide	Wide mouth glass w/ teflon cap ³	Cool to 4°C	Metals - 6 months Mercury - 26 days Cyanide - 12 days

NOTES

1. All samples to be preserved in ice at 4°C during collection and transport.
 2. Days from verified time of sample receipt (VTSR) by the laboratory.
 3. Sized appropriately for the analytical method.
 4. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in containerization requirements, the Site-Specific Work Plan (which will include this information) will take precedence.
- * Extraction of water samples for pesticides/PCB analysis by separating funnel must be completed within five days of VTSR. Continuous liquid-liquid extraction is the required extraction for water samples for semivolatiles. Continuous liquid-liquid extraction of water samples, or sonication or soxhlet procedures for semivolatile and pesticides/PCB analyses, shall be started within five days. If a re-extraction and reanalysis must be performed, the extraction must start within 10 days and completed within 12 days of VTSR. Extracts of either water or soil/sediment samples must be analyzed within 40 days of VTSR.

TABLE 2
LABORATORY ANALYSIS PROGRAM

Matrix	Parameter ¹	Analytical Method ²
Water	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	PCBs and Pesticides	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
Soil & Sediments	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	Pesticides and PCBs	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
Waste Characteristics	TCLP	Method 1311; Method Series 7000, 8000
		Methods 1010/1020A; 9040B/9041A; Section 7.3

NOTES

- Abbreviations: BTEX = Benzene, Toluene, Ethylbenzene, Xylene; VOCs = Volatile organic compounds; SVOCs = Semivolatile organic compounds; PAHs = Polycyclic aromatic Hydrocarbons; TCLP = Toxicity Characteristic Leaching Procedure; PCBs = Polychlorinated Biphenyls; CLP = Contract Laboratory Program.
 - NYSDEC Analytical Services Protocol, 2001, Category B deliverables.
Analyses must meet NYSDEC ASP holding time specified for Methods in Exhibit I Part II.
 - If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in analytical requirements, the Site-Specific Work Plan (which will include this information) will take precedence
- * BTEX and PAH analyses must meet NYSDEC ASP holding time specified for Methods 2001-1 and 2001-2, respectively.

FIGURE 1

DATA REDUCTION, VALIDATION AND REPORTING

Figure 1

DATA REDUCTION, VALIDATION & REPORTING SCHEME

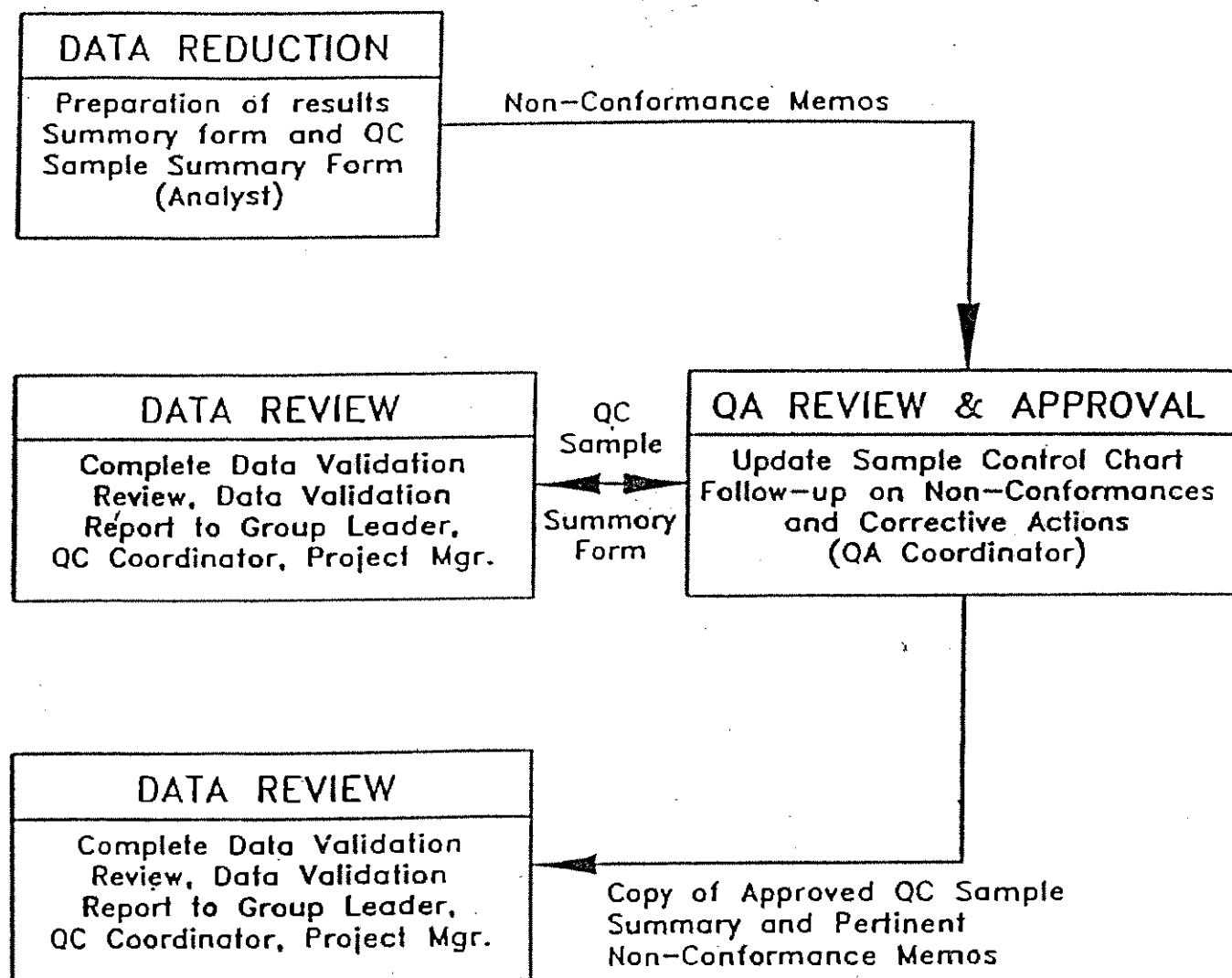
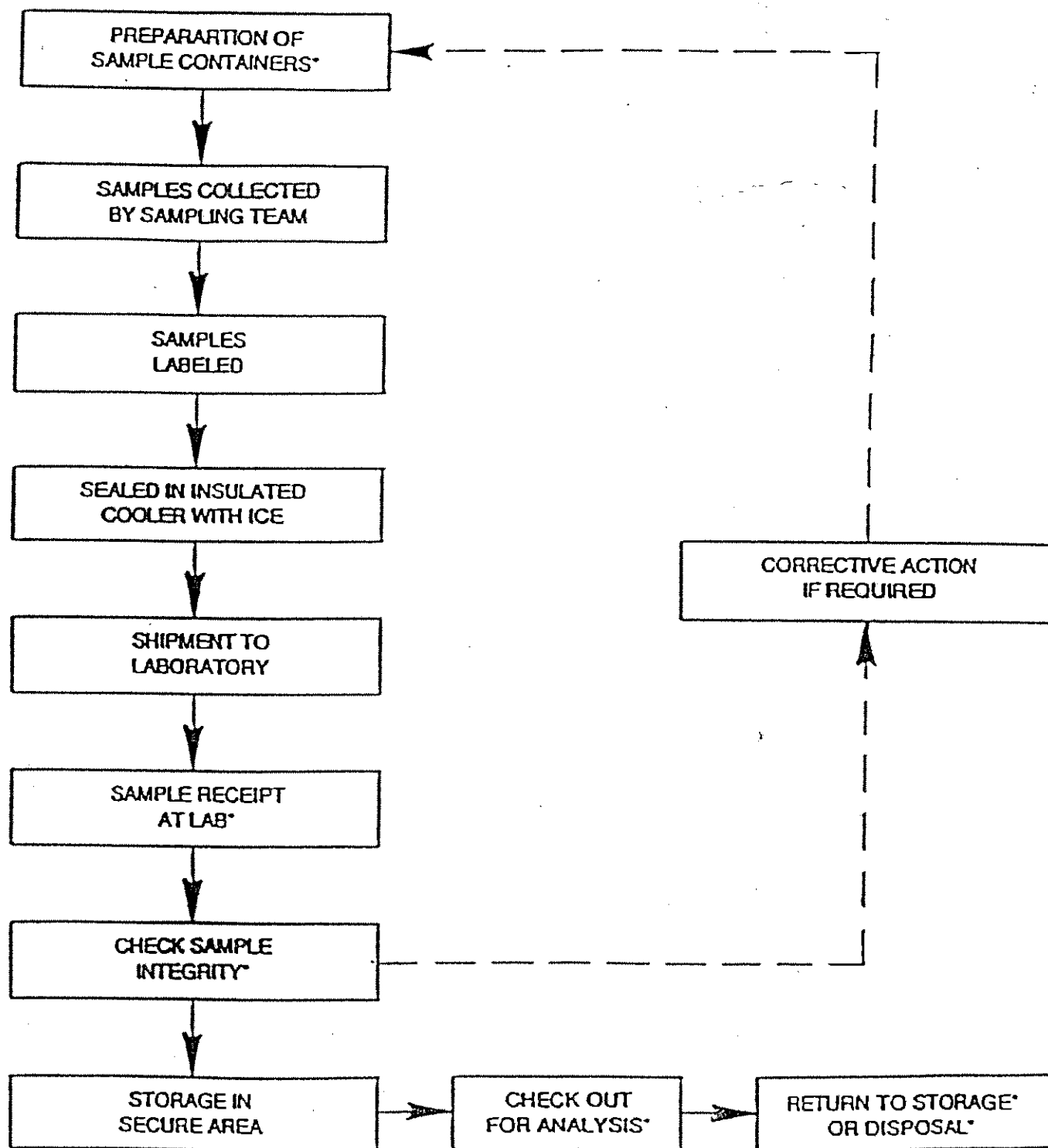


FIGURE 2

SAMPLE CUSTODY

Figure 2

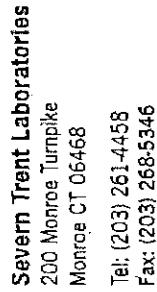
SAMPLE CUSTODY



* Requires sign-off on Chain of Custody Form.

FIGURE 3

CHAIN-OF-CUSTODY RECORD



PAGE _____ OF _____ NO. _____

YES ☐ NO ☐

[illegible]

MATRIX CODES		BOTTLES PREPARED BY	DATE / TIME	BOTTLES REC'D BY	DATE / TIME	RECEIVED BY (SEE REMARKS)	
A - AIR	S - SOIL	SIGNATURE		SIGNATURE		☐ BOTTLES INTACT	☐ CUSTODY SEALS
AQ - AQUEOUS	SL - SLUDGE					☐ PRESERVED	☐ SEALS INTACT
C - COMPLEX	W - WIPE	SAMPLES COLLECTED BY	DATE / TIME	RECEIVED IN LAB BY	DATE / TIME	☐ CHILLED	☐ SEE REMARKS
D - DRUM WASTE	O - OTHER						
OI - OIL	FB - FIELD BLANK	SIGNATURE					
	TB - TRIP BLANK						

LABORATORY COPY

FIGURE 4

DAILY STATUS AND MONITORING REPORT

DAILY STATUS & MONITORING REPORT
Niagara Mohawk SIR & MSA Programs

Date: _____ Site Name: _____

Project Manager: _____ Project Field Operations Lead: _____

Description of Field Work Performed:

Media	Sample Number	Types of Analyses	Sample Sent to Lab? (Y/N)	Comments

Means of Sample Shipment to Laboratory? Name and Location of Laboratory:

Issues/Concerns Raised:

Work to be Performed Tomorrow:

Name of Preparer: _____

FIGURE 5

CORRECTIVE ACTION REQUEST FORM

Figure 5

CORRECTIVE ACTION REQUEST		CAR NO. _____ DATE _____
PROJECT NO./TITLE _____ _____ _____	REFERENCE(S) _____ _____	
TASK NO./TITLE _____ _____	REPLY DUE DATE _____	
SUBJECT _____ _____	PREPARED BY _____	
DESCRIPTION OF CONDITION	APPROVED BY _____ PROJECT MANAGER	
CAUSE AND CORRECTIVE ACTION (Include Effective Date)		
TASK MANAGER _____ DATE _____	PROJECT QA OFFICER _____ DATE _____	PROJECT MANAGER _____ DATE _____
CLOSEOUT ACTION		
PROJECT QA OFFICER _____ DATE _____	PROJECT MANAGER _____ DATE _____	SEE REVERSE SIDE FOR INSTRUCTIONS

ATTACHMENT 1

**ENSYS FIELD PAH AND PCB SOIL TEST TECHNICAL GUIDES AND TEST
KIT INSTRUCTIONS**

STRATEGIC DIAGNOSTICS INC.

PAH EnSys[®] 12T SOIL TEST SYSTEM

70613

RAPID IMMUNOASSAY SCREEN

User's Guide

This method correctly identifies 95% of samples that are PAH-free and those containing 1ppm or greater of PAHs. A sample that develops less color than the standard is interpreted as positive. It contains PAHs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PAHs.

IMPORTANT NOTICE

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of PAHs. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLE SHOOTING GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

Wash Step - Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. *Solution:* Make sure that the operator washes four times vigorously.

Pipette Calibration - An out-of-calibration pipette may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution:* Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipette is out of calibration is if the gold barrel is loose and will turn. (When set on 30 μ l there should be about 1/4 of an inch between the white plunger and the end of the clear pipette tip.)

Air bubbles in the pipette - the presence of air bubbles in the pipette tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution:* quickly examine the pipette tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if necessary.

Mixing - Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution:* observe the mixing times in the instructions and to mix with sufficient force to ensure that the liquid is homogeneous.

Timing - it is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the test. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

Addition of Drops - it is important to carefully count the drops added to color development steps. The addition of ± 1 drop to the instructed 5 drops can cause variability in the results RIGHT AROUND THE DETECTION LEVELS OF INTEREST. One drop less could result in a darker color (a less dilute solution) and result in a false negative. One drop more could result in a lighter color (a more dilute solution) and result in a false positive.

Wiping the Tubes - wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

Mixing Lot #'s - never mix lots! Each kit's components are QC'd together for optimal performance and may give inaccurate results with components from other kits, that are not of the same lot #. Also, the user must NEVER mix components from different types of kits (ex: Petro kit buffer tubes can't be used with a PAH kit).

Storage and Operating Temperatures - temperature requirements are very important and should be strictly adhered to. This information can be found in the kit User's Guide.

Shelf-life - each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

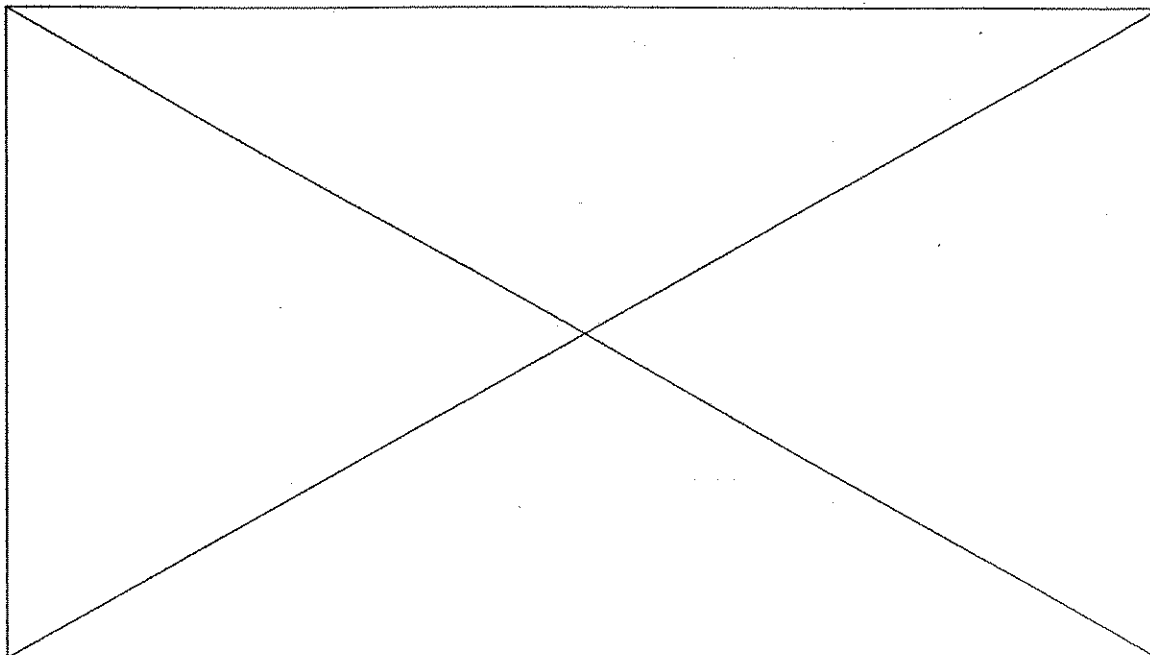
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- Mechanical pipette tips
- Stop solution
- Standard vial
- 4 antibody coated tubes

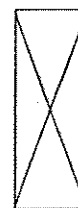
- Substrate A
- Filtration barrel & plunger
- 1 and 10 ppm
- dilution ampules

- Substrate B
- Bulb pipette
- 4 blue buffer tubes
- 4 conjugate tubes

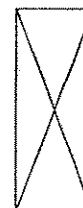


READ BEFORE PROCEEDING

- Follow diagram above to setup workstation.
- Items that you will need that are not provided in the test kit include:
a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PAHs at 1 and 10 ppm.



PAH
Standard



Ampule
Cracker

TEST PREPARATION

- Label amber vial "PAH standard" and the current date; Standard is usable for up to 2 weeks from this date. Open PAH Standard ampule by slipping ampule cracker over top, and then breaking top at scored neck. Transfer to empty amber vial with bulb pipette. Always cap tightly when finished using Standard.



Bulb Pipette

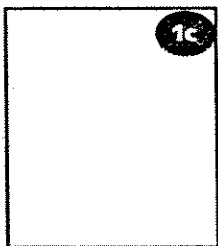


Amber Vial

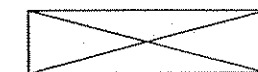
PHASE 1 SAMPLE EXTRACTION & PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

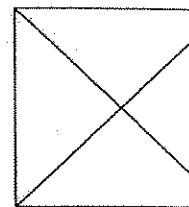
WEIGH SAMPLE



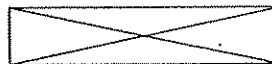
- 1a Place unused weigh boat on pan balance.
- 1b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.
- 1c Weigh out 10 + / - 0.1 grams of soil.
- 1d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Pan balance

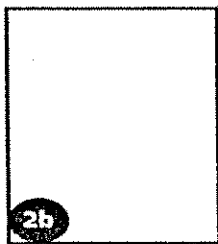


Weigh Boat

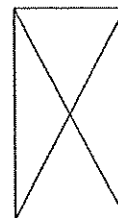


Wooden spatula

EXTRACT PAHS

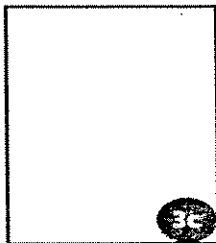


- 2a Uncap extraction jar and place on flat surface. Without contacting solvent, puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.
- 2b Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.
- 2c Recap extraction jar tightly and shake vigorously for one minute.
- 2d Allow to settle for one minute. Repeat steps 1a -2c for each sample to be tested.



Sample extraction jar

FILTER SAMPLE



- 3a Remove lid from extraction jar.
- 3b Disassemble filtration plunger from filtration barrel.
- 3c Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer at least 1/2 bulb capacity into filtration barrel. Do not use more than one full bulb.
- 3d Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).



Filtration plunger



Filtration barrel

Bulb pipette

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM FOR DETECTION LEVELS OTHER THAN 1 & 10PPM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.
2. At your request, your kit may include extra dilution ampules to reach high detection levels.
3. **EVERY AMPULE PROVIDED MUST BE USED!**

If there are any questions concerning the dilution procedure please call Technical Services before running the samples to help avoid costly mistakes.

1-800-544-8881.

EXAMPLE:

Lowest ppm

Intermediate ppm

Highest ppm

Dilution
Ampules

NOTE: Your order may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Label the glass conjugate and plastic antibody coated tubes with a permanent marking pen.
- When using the mechanical pipette always withdraw and dispense below the liquid level. Instructions for operating the Mechanical Pipette are found on page 13.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE AND BUFFER SAMPLE FOR 1 PPM AND 10 PPM DETECTION LEVELS

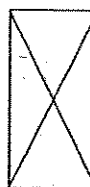
- 4a Uncap enough blue buffer, conjugate, and antibody coated tubes for Samples and Standards.
- 4b Empty a blue buffer tube into each conjugate tube.
- 4c Assemble new tip onto mechanical pipette.
- 4d Open 1 and 10 ppm dilution ampules by slipping ampule cracker over tip, and then breaking top at scored neck.

PHASE 2 SAMPLE & STANDARD PREPARATION

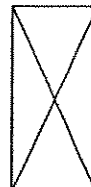
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

DILUTE AND BUFFER SAMPLE

- 4e Withdraw 75 μ L of filtered sample using mechanical pipette and dispense below the liquid level in 1 ppm dilution ampule. Gently shake ampule for 5 seconds.

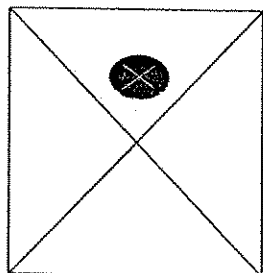


Dilution
ampules
(1 & 10 ppm)

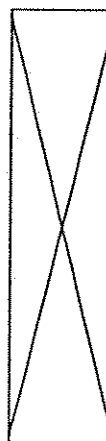


Plastic
Safety
Sleeve

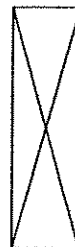
- 4f Withdraw 75 μ L of diluted sample from the 1 ppm dilution ampule and dispense below the liquid level in the 10 ppm dilution ampule. Gently shake ampule for 5 seconds.



- 4g Withdraw 75 μ L of diluted sample from 10 ppm dilution ampule and dispense below the liquid level in corresponding conjugate tube. Always wipe tip after dispensing into conjugate tube. Withdraw 75 μ L of 1 ppm sample and dispense into corresponding conjugate tube.

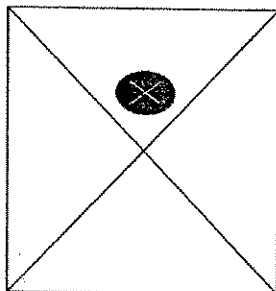


Mechanical
pipette

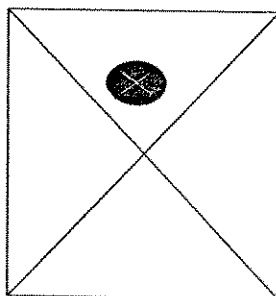


Mechanical
pipette
tip

- 4h Assemble new tip onto mechanical pipette and withdraw 75 μ L of PAH Standard and dispense below the liquid level in two conjugate tubes. Immediately replace cap on PAH Standard vial.



- 4i Gently shake conjugate tubes for 5 seconds.

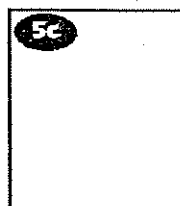
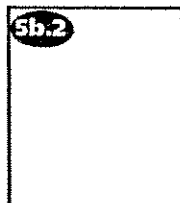


READ BEFORE PROCEEDING

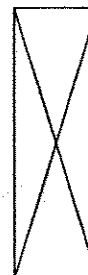
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM CONJUGATE TUBE TO ANTIBODY COATED TUBE



- 5a. Set timer for 10 minutes.
- 5b. Working left to right in the workstation:
 - 1. Fit all antibody coated tubes firmly on top of all corresponding conjugate tubes.
 - 2. **Start timer and immediately invert all connected tube pairs** so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.
- 5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.
- 5d. Disconnect and discard the smaller glass conjugate tubes. [It is not important to worry about drops of liquid adhering to lips of tubes].



Antibody coated tubes (contained in resealable "zip-seal" aluminumized pouch)

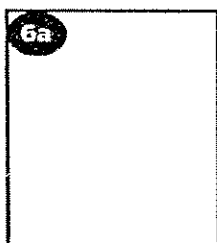
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

DILUTE AND BUFFER SAMPLE

4e Withdraw 75 μ L of filtered sample using mechanical pipette and dispense below the liquid level in 1 ppm dilution ampule. Gently shake ampule for 5 seconds.

4f Withdraw 75 μ L of diluted sample from the 1 ppm dilution ampule and dispense below the liquid level in the 10 ppm dilution ampule. Gently shake ampule for 5 seconds.



4g Withdraw 75 μ L of diluted sample from 10 ppm dilution ampule and dispense below the liquid level in corresponding conjugate tube. Always wipe tip after dispensing into conjugate tube. Withdraw 75 μ L of 1 ppm sample and dispense into corresponding conjugate tube.



Wash bottle

4h Assemble new tip onto mechanical pipette and withdraw 75 μ L of PAH Standard and dispense below the liquid level in two conjugate tubes. Immediately replace cap on PAH Standard vial.

4i Gently shake conjugate tubes for 5 seconds.

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- This phase of the procedure requires critical timing and care in handling the antibody coated tubes.

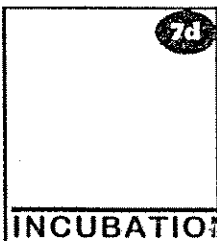
ADD ENZYME

- 6a Dispense first drop from enzyme dropper into liquid waste container.

Note: before dispensing drops, tap capped tip on hard surface to avoid dispensing air bubbles.

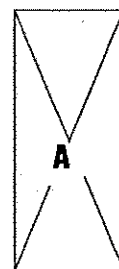
- 6b Dispense 3 drops of enzyme into each blue buffer tube by squeezing the dropper.

- 6c Shake buffer tubes for 5 seconds.

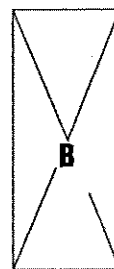


INCUBATION

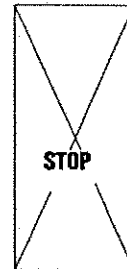
- 7a Set timer for 10 minutes.
- 7b Start timing and immediately pour solution from each blue buffer tube into appropriate antibody coated tube.
- 7c When pouring is complete, gently shake all 4 tubes for 5 seconds.



Substrate A



Substrate B

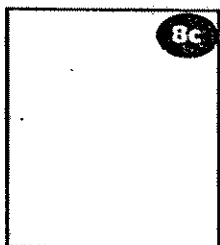


Stop

PHASE 4 INTERPRETATION

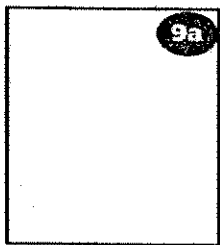
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



- 8a Wipe outside of all antibody coated tubes.
- 8b Place both Standard tubes in photometer.
- 8c Switch tubes until the photometer reading is negative or zero. Record reading.
If reading is greater than - 0.3 in magnitude , results are outside QC limits. Retest the sample(s).
- 8d Remove and discard tube in right well. The tube in the left well is the more conservative standard and should be used.

MEASURE SAMPLE



- 9a Place 1 ppm tube in right well of photometer and record reading shown on display.
If photometer reading is negative or zero, PAHs are present.
If photometer reading is positive, concentration of PAHs are less than 1 ppm.
- 9b Place 10 ppm tube in right well of photometer and record reading shown on display.
If photometer reading is negative or zero, PAHs are present.
If photometer reading is positive, concentration of PAHs are less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

How It Works

Standards, Samples, and color-change reagents are added to test tubes coated with a chemical specific to PAHs. The concentration of PAHs in an **unknown Sample** is determined by comparing its color intensity with that of a **Standard**.

Note: PAHs concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PAHs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after its expiration date.
- Each analysis must include 2 **Standards**, with no more than a total of 12 antibody coated tubes.
- Do not exceed incubation periods prescribed by the specific steps.
- Results may not be valid if photometer reading for **Standards** exceed 0.3 in magnitude.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If liquid from the extraction jar, or PAH Standard comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 40° F/4 °C and less than 90° F/32° C.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

System Description

Each PAH RiSc Soil Test System contains enough material to perform four complete tests, each at 1 and 10 ppm.

The PAH RiSc Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free:

1-800-544-8881.

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PAH-free soil and soil containing 1 ppm and 10 ppm of PAHs were tested with the EnSys® PAH analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PAHs. Either a 1 ppm or a 10 ppm sample that has developed more color than the standard is interpreted as negative. It contains less than the indicated level of PAHs (1 ppm or 10 ppm).

The company does not guarantee that the results with the EnSys® PAH Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

Strategic Diagnostics Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

SDI neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall SDI be liable for incidental or consequential damages resulting from the use or handling of this product.

MECHANICAL PIPETTE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE MECHANICAL PIPETTE

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "075". Tighten volume lock screw and replace push-button cap.

To Assemble Pipette Tip

Slide larger mounting end of pipette tip onto end of pipette. Holding tip in place, press push-button until plunger rod enters pipette tip. Ensure no gap exists between piston and plunger rod (see illustration).

To Withdraw Sample

With tip mounted in position on pipette, press push-button to first stop and hold it. Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipette, please refer to your pipette manual.

Push-button
Cap

Plunger Rod
Piston
Pipette Tip

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS SDI EnSys® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

- A. **Sample Documentation**
 - 1. Location, depth
 - 2. Time and date of collection and field analysis
- B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)
- C. **Method calibration** - this is an integral part of EnSys RIS[®] immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)
- D. **Method blank** - analyze methanol from the extraction jar.
- E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect
- F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate
- G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.
- H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance
- I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. 1-800-544-8881.

[illegible]

STRATEGIC DIAGNOSTICS INC.

PCB EnSys[®] 12T SOIL TEST SYSTEM

70203

RAPID IMMUNOASSAY SCREEN

User's Guide

IMPORTANT NOTICE

This method correctly identifies 95% of samples that are PCB-free and those containing 1 ppm or greater of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of polychlorinated biphenyls. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLESHOOTING GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. *Solution:* Make sure to wash four times vigorously, washing the whole set of 12 tubes at once.

PIPET CALIBRATION

An out-of-calibration pipet may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution:* Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipet is out of calibration is if the gold barrel is loose and will turn. (When set on 30 μ l there should be about a 1/4 of an inch between the white plunger and the end of the clear pipet tip.)

AIR BUBBLES IN THE PIPET

The presence of air bubbles in the pipet tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution:* Quickly examine the pipet tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if necessary.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution:* Observe the times in the instructions and mix with sufficient force to ensure that the liquid is homogenous.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

WIPING THE TUBES

Wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PAH kit).

STORAGE AND OPERATING TEMPERATURES

Temperature requirements are very important and should be strictly adhered to. This test kit should be stored at less than 80°F/27°C and operated between 40°F/4°C and 90°F/32°C.

SHELF-LIFE

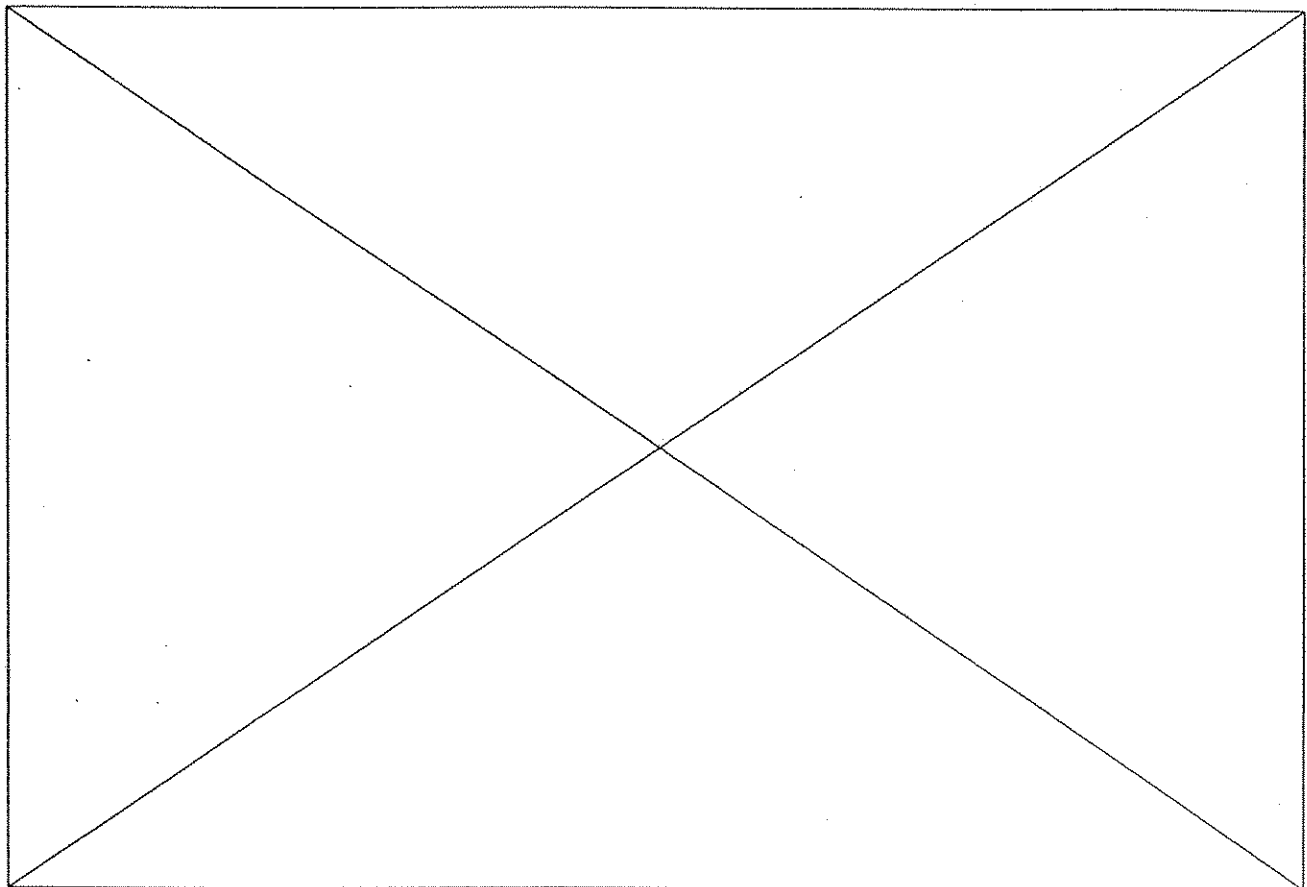
Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- Mechanical pipet tips
- Filter barrels & plungers
- Ampule cracker
- Glass PCB buffer tubes
- Substrate A
- Eppendorf pipet tips
- Bulb pipets
- PCB standard
- Antibody coated tubes
- Substrate B
- Extraction Jars
- 1 & 10 ppm dilution ampules
- Stop Solution



Workstation shows components for 3 samples tested at 2 levels

TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Do not attempt to run more than 12 tubes, two of which must be standards.
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PCBs at 1 and 10 ppm. See table on page 10 for sensitivity to various Aroclors.

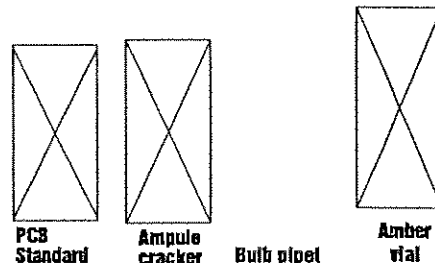
TEST PREPARATION

- Label all Eppendorf repeater tips. Tips can be reused for future analyses. Label the first 5mL tip "A", the second 5mL tip "B" and the third 5mL tip "Stop".
- Label the 12.5 mL tip "Buffer".



STANDARD PREPARATION

- Open PCB Standard ampule by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer solution to empty vial with Bulb Pipets.
- Label vial with current date. Standard is usable for 2 weeks. Always cap tightly when finished using standard.



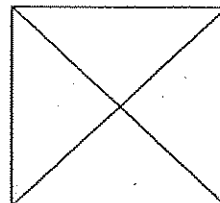
PHASE 1

EXTRACTION & PREPARATION OF THE SAMPLE

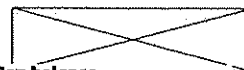
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

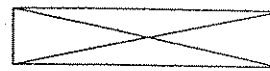
- 1a. Place unused weigh boat on pan balance.
- 1b. Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.
- 1c. Weigh out 10 $\pm$ 0.1 grams of soil.
- 1d. If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Weigh Boat



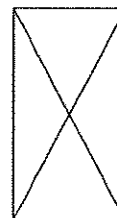
Pan balance



Wooden spatula

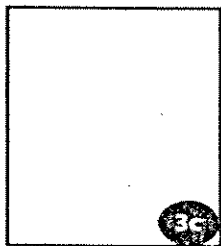
EXTRACT PCBS

- 2a. Uncap extraction jar and place on a flat surface. Without contacting solvent puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.
- 2b. Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.
- 2c. Recap extraction jar tightly and shake vigorously for one minute.
- 2d. Allow to settle for one minute. Repeat steps 1a - 2c for each sample to be tested.

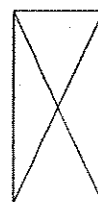


Extraction jar

FILTER SAMPLE



- 3a. Disassemble filtration plunger from filtration barrel.
- 3b. Insert bulb pipet into top (liquid) layer in extraction jar and draw up sample. Transfer at least $\frac{1}{2}$ bulb capacity into filtration barrel. Do not use more than one full bulb.
- 3c. Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary). Repeat steps 3a - 3c for each sample to be tested.



Filtration plunger



Filtration barrel

Bulb pipet

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.
2. Your kit may include extra dilution ampules to reach high detection levels.
3. EVERY AMPULE PROVIDED MUST BE USED!

If there are any questions concerning the dilution procedure please call SDI Technical Services before running the samples to help avoid costly mistakes. (1-800-544-8881)

EXAMPLE:

Lowest ppm

Intermediate ppm

Highest ppm

Dilution
Ampules

NOTE: Your Kit may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

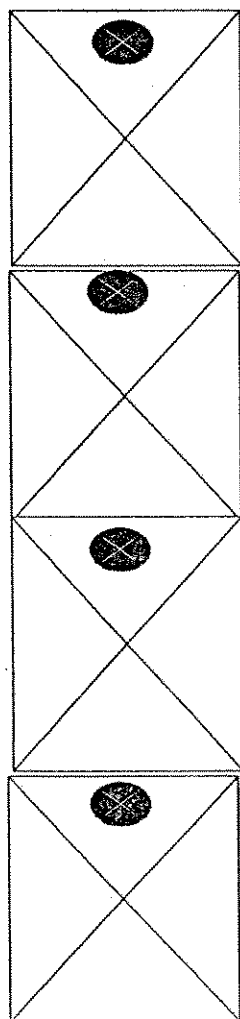
PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

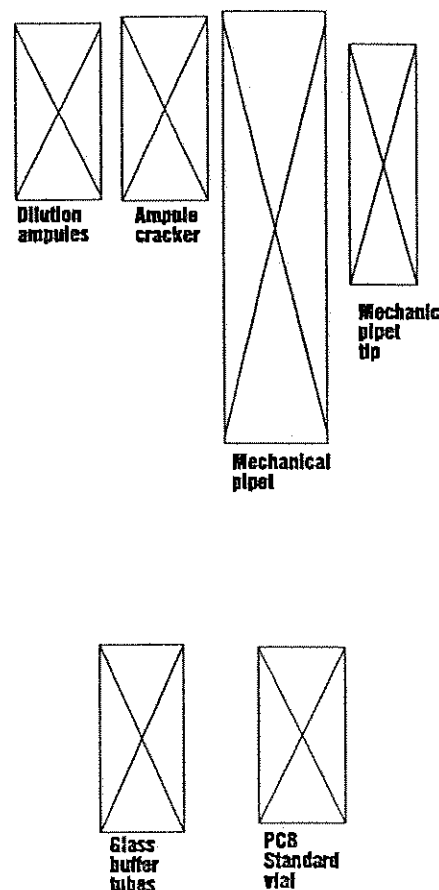
READ BEFORE PROCEEDING

- Label the plastic antibody coated tubes with a permanent marking pen.
- When using the mechanical pipet always withdraw and dispense below the liquid level.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE SAMPLES AND STANDARDS



- 4a. Set the Eppendorf Repeater on 4, assemble the "Buffer" tip and fill with Buffer.
- 4b. Dispense 1 mL of Buffer into each glass buffer tube.
- 4c. Open 1 and 10 ppm dilution ampules by slipping ampule cracker over top, and then breaking top at scored neck.
- 4d. Withdraw 60 μ L of filtered sample using mechanical pipet and dispense below the liquid level in "1 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.
- 4e. Withdraw 60 μ L from the "1 ppm" dilution ampule using mechanical pipet and dispense below the liquid level in "10 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.
- 4f. Transfer 60 μ L from each dilution ampule into glass buffer tubes. Always wipe tip after dispensing into buffer tube.
- 4g. Change pipet tip and repeat 4d - 4f for each sample.
- 4h. Assemble new pipet tip on mechanical pipet and transfer 60 μ L from Standard vial into two glass buffer tubes. Immediately replace cap on PCB Standard vial.
- 4i. Shake all glass buffer tubes for 5 seconds.



PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM DILUTION TUBE TO ANTIBODY COATED TUBE

5b.1

5a. Set timer for 10 minutes

5b. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding glass buffer tubes.
2. Start timer and immediately invert all connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

5b.2

5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

5c

5d. Disconnect and discard the smaller (dilution) tubes. It is not important to worry about drops of liquid adhering to lips of tubes.

5e. Place conjugate tubes behind antibody tubes in workstation. Remove grey caps and discard.

TRANSFER OF CONJUGATE TO ANTIBODY COATED TUBES

AFTER 10 MINUTES, IMMEDIATELY:

6b

6a. Set timer for 5 minutes.

6b. Working left to right in the workstation:

Start timer and immediately:

Dissolve the conjugate pellets by horizontally connecting the antibody coated tubes and conjugate tubes and tilt the liquid up to pour it onto the conjugate.

6c

6c. Return the connected tubes to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom. It is important that this step is completed within one minute for all tubes.

6d

6d. In order to adequately mix solution, invert all connected tube pairs several more times making sure that the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

6e. Disconnect and discard the conjugate tubes. It is not important to worry about the loss of liquid adhering to lip of tubes.

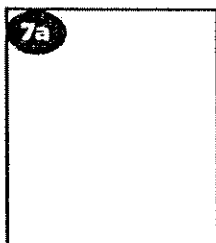
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

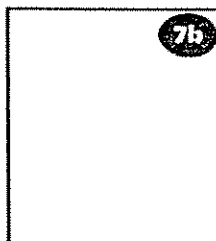
READ BEFORE PROCEEDING WASH PROCEDURE

- An accurate test requires a vigorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a harmless, dilute solution of detergent.

WASH



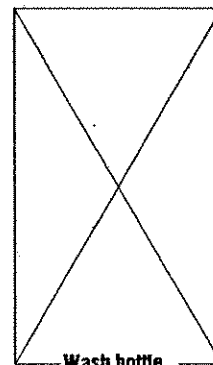
7a After the 5 minute incubation, empty antibody coated tubes into liquid waste container.



7b Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

7c Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.



PHASE 3 THE IMMUNOASSAY

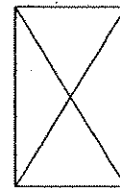
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

COLOR DEVELOPMENT

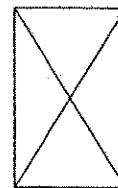
- 8a. Set the Eppendorf Repeater on 2, assemble the "A" tip and fill with Substrate A (TMB, yellow label).
- 8b. Dispense once (200 μ L) into each antibody coated tube.
- 8c. Set timer for exactly 2 1/2 minutes.
- 8d. Assemble "B" tip, fill with Substrate B, start timer, and dispense once (200 μ L H_2O_2 , green label) into each antibody coated tube.
- 8e. Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.
- 8f. Assemble "Stop" tip, fill with Stop Solution (red label), and stop reaction at end of 2 1/2 minutes by dispensing once (200 μ L) into each antibody coated tube.



Substrate A



Substrate B



Stop

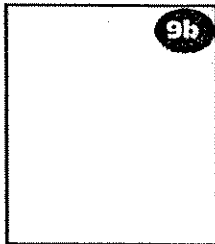
AROCLOR SENSITIVITY

Aroclor	Lowest Detection Level
1248	1.0 ppm
1254	0.5 ppm
1260	0.5 ppm
1242	2.0 ppm
1232	4.0 ppm
1016	4.0 ppm

PHASE 4 ANALYSIS OF RESULTS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



- 9a. Wipe outside of all antibody coated tubes.
- 9b. Place both Standard tubes in photometer.
- 9c. Switch tubes until the photometer reading is negative or zero. Record reading.
If reading is greater than - 0.3 in magnitude (reading is less than or lower than - 0.3), results are outside QC limits. Retest the sample(s). (See QC Example)
- 9d. Remove and discard tube in right well. The tube in the left well is the conservative standard.

QC Check Example:

If the photometer reading (with both Standard tubes) is **-0.34** or **0.34**, results are outside the QC limits, and the samples should be retested.

If the photometer reading (with both Standard tubes) is **-0.27** or **0.27**, results are within the QC limits, and testing may proceed.

MEASURE SAMPLE



- 10a. Place 1 ppm tube in right well of photometer and record reading.
If photometer reading is negative or zero, PCBs are present.
If photometer reading is positive, concentration of PCBs is less than 1 ppm.
- 10b. Place 10 ppm tube in right well of photometer and record reading.
If photometer reading is negative or zero, PCBs are present.
If photometer reading is positive, concentration of PCBs is less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each SDI PCB EnSys® Soil 12 Test Case contains enough material to perform 12 test samples, each at two detection levels.

The SDI PCB EnSys Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-544-8881.

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 1 ppm or greater of PCBs were tested with the SDI EnSys PCB analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

SDI does not guarantee that the results with the PCB EnSys Soil 12 Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown **Sample** is determined by comparing its color intensity with that of a **Standard**.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are Standards) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always follow the procedure in this user's guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.

REPEATER PIPET & MECHANICAL PIPET

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE REPEATER PIPET

To Set Or Adjust Volume

To determine the pipetting volume, the dial setting (1-5) is multiplied by the minimum pipetting volume of the tip.

To Assemble Pipet Tip

Slide filling lever down until it stops. Then raise the locking clamp and insert the tip until it clicks into position. Be sure the tip plunger is fully inserted into the barrel before lowering the locking clamp to affix the tip in place.

To Fill Tip

With tip mounted in position on pipet, immerse end of tip into solution. Slide filling lever upward slowly.

To Dispense Sample

Check the volume selection dial to ensure pipetting volume. Place tip inside test tube so that tip touches the inner wall of tube. Completely depress the pipetting lever.

To Eject Tip

Empty tip of any remaining solution into appropriate container. Raise locking clamp upward, and remove the tip.

For additional information regarding operation and use of repeater, please refer to your Repeater pipet manual.

Mechanical Pipet

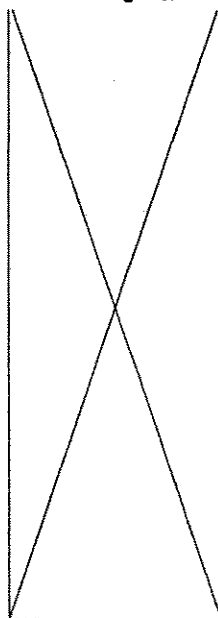
Push-button Cap

Plunger Rod

Piston

Pipet Tip

Repeater Pipet



HOW TO OPERATE THE MECHANICAL PIPET

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "060". Tighten volume lock screw and replace push-button cap.

To Assemble Pipet Tip

Slide larger mounting end of pipet tip onto end of pipet. Holding tip in place, press push-button until plunger rod enters pipet tip. Ensure no gap exists between piston and plunger rod.

To Withdraw Sample

With tip mounted in position on pipet, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject). Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipet, please refer to your pipet manual.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS SDI EnSys® 12 TEST SYSTEM

Please read the following before proceeding with field testing.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

- A. **Sample Documentation**
 - 1. Location, depth
 - 2. Time and date of collection and field analysis
- B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)
- C. **Method calibration** - this is an integral part of SDI's EnSys immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)
- D. **Method blank** - analyze methanol from the extraction jar.
- E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect
- F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate
- G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.
- H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance
- I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. (1-800-544-8881)

[illegible]

APPENDIX H

SITE MANAGEMENT FORMS

FIGURE 1

SITE NAME:

MONITORING WELL FIELD INSPECTION LOG
NYSDEC WELL DECOMMISSIONING PROGRAM

SITE ID.: _____
INSPECTOR: _____
DATE/TIME: _____
WELL ID.: _____

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back).....		

	YES	NO
WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL:		
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED.....
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable)
PROTECTIVE CASING MATERIAL TYPE:
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches):

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet):
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet):
MEASURE WELL DIAMETER (Inches):
WELL CASING MATERIAL:
PHYSICAL CONDITION OF VISIBLE WELL CASING:
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES.....

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.)
AND ASSESS THE TYPE OF RESTORATION REQUIRED.

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT
(e.g. Gas station, salt pile, etc.):

REMARKS:

Summary of Green Remediation Metrics for Site Management

Site Name: _____ Site Code: _____
Address: _____ City: _____
State: _____ Zip Code: _____ County: _____

Initial Report Period (Start Date of period covered by the Initial Report submittal)

Start Date: _____

Current Reporting Period

Reporting Period From: _____ To: _____

Contact Information

Preparer's Name: _____ Phone No.: _____

Preparer's Affiliation: _____

I. Energy Usage: Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

	Current Reporting Period	Total to Date
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal (Btu))		

Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.

II. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	Total to Date (tons)
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

III. Transportation/Shipping: Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	Total to Date (miles)
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

IV. Water Usage: Quantify the volume of water used on-site from various sources.

	Current Reporting Period (gallons)	Total to Date (gallons)
Total quantity of water used on-site		
Of that total amount, provide quantity:		
Public potable water supply usage		
Surface water usage		
On-site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.

V. Land Use and Ecosystems: Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period (acres)	Total to Date (acres)
Land disturbed		
Land restored		

Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR
I, _____ (Name) do hereby certify that I am _____ (Title) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application.
_____ _____ Date Contractor

ENVIRONMENTAL EASEMENT AND ENGINEERING CONTROL INSPECTION FORM
Patchogue Former Manufactured Gas Plant

A. General Information:

Inspector: _____ Inspection Date: _____ Last Inspection Date: _____
Title: _____ Affiliation (employer): _____
Street Address: _____ City: _____
State: _____ Zip Code: _____ Telephone: _____ Email: _____

B. Site Location:

Site Street Address: _____ Municipality: _____
County: _____ State: _____ Block(s): _____ Lot(s): _____

C. Institutional Controls:

1. Is the current land use consistent with Environmental Easement? Yes _____ No _____ If no, explain below.

2. Do the institutional and engineering controls continue as designed and intended to protect the public health and safety and the environment? Yes _____ No _____ If no, explain below.

3. Was each alteration or disturbance (e.g., penetration) of the engineering control, if any, performed expediently and appropriately to maintain the integrity of the engineering control? Yes _____ No _____ If no, explain below.

4. Do any new standards, regulations, or laws apply to the site that might necessitate the implementation of additional procedures, apart from those specified in the Environmental Easement, to evaluate the protectiveness of the engineering control? Yes _____ No _____ If yes, explain below.

ENVIRONMENTAL EASEMENT AND ENGINEERING CONTROL INSPECTION FORM
Patchogue Former Manufactured Gas Plant

D. Engineering Control Conditions (Use extra sheet provided, if needed):

1(a) Engineering Control Type: _____

(b) Condition of the Engineering Control surface (describe any cracks, disturbances, etc.):

(c) Describe maintenance activities performed, if any, during reporting period:

(d) Are repairs needed? Yes _____ No _____ If yes, describe type, location, and size of repair area. (Mark locations on attached site map. Attach pre-and post- repair photographs on the "Photograph Log". Use additional sheets if necessary.)

2 (a) Engineering Control Type: _____

(b) Condition of the Engineering Control surface (describe any cracks, disturbances, etc.):

(c) Describe maintenance activities, if any, performed during reporting period:

(d) Are repairs needed? Yes _____ No _____ If yes, describe type, location, and size of repair area. (Mark locations on attached site map. Attach pre-and post- repair photographs on the "Photographic Log". (Use additional sheets if necessary.)

I, hereby, certify that the engineering controls were inspected and maintained and its integrity remains so that the remedial action continues to be protective of the public health and safety and of the environment.

Inspector's Name (print or Type): _____ Title: _____

Inspector's Signature: _____ Date: _____



Upper Saddle River, NJ Office

LOW-FLOW GROUNDWATER SAMPLING FIELD DATA

Well Number: _____

Sample I.D.: _____

(if different from well no.)

Project: _____
Personnel: _____

Date: _____ Time: _____
Weather: _____ Air Temp.: _____

WELL DATA:

Casing Diameter: _____ ☐ Stainless Steel ☐ Steel ☐ PVC ☐ Teflon® ☐ Other: _____
Intake Diameter: _____ ☐ Stainless Steel ☐ Galv. Steel ☐ PVC ☐ Teflon® ☐ Open rock
DEPTH TO : Static Water Level: _____ ft Bottom of Well: _____ ft
DATUM: ☐ Top of Protective Casing ☐ Top of Well Casing ☐ Other: _____
CONDITION: Is Well clearly labeled? ☐ Yes ☐ No Is well clean to bottom? ☐ Yes ☐ No
Is Prot. Casing/Surface Mount in Good Cond.? (not bent or corroded) ☐ Yes ☐ No
Does Weep Hole adequately drain well head? ☐ Yes ☐ No
Is Concrete Pad Intact? (not cracked or frost heaved) ☐ Yes ☐ No
Is Padlock Functional? ☐ Yes ☐ No ☐ NA Is Inner Casing Intact? ☐ Yes ☐ No
Is Inner Casing Properly Capped and Vented? ☐ Yes ☐ No

VOLUME OF WATER: Standing in well: _____ To be purged: _____

PURGE DATA:

METHOD: ☐ Bailer, Size: _____ ☐ Bladder Pump ☐ 2" Submersible Pump ☐ 4" Submersible Pump
☐ Centrifugal Pump ☐ Peristaltic Pump ☐ Inertial Lift Pump ☐ Other: _____
MATERIALS: Pump/Bailer: ☐ Teflon® ☐ Stainless Steel ☐ PVC ☐ Other: _____
Tubing/Rope: ☐ Teflon® ☐ Polyethylene ☐ Polypropylene ☐ Other: _____
Pumping Rate: _____ Elapsed Time: _____ Volume Pumped: _____
Was well Evacuated? ☐ Yes ☐ No Number of Well Volumes Removed: _____
PURGING EQUIPMENT: ☐ Dedicated ☐ Prepared Off-Site ☐ Field Cleaned

SAMPLING DATA:

METHOD: ☐ Bailer, Size: _____ ☐ Bladder Pump ☐ 2" Submersible Pump ☐ 4" Submersible Pump
☐ Syringe Sampler ☐ Peristaltic Pump ☐ Inertial Lift Pump ☐ Other: _____
MATERIALS: Pump/Bailer: ☐ Teflon® ☐ Stainless Steel
Tubing/Rope: ☐ Teflon® ☐ Polyethylene
SAMPLING EQUIPMENT: ☐ Dedicated ☐ Prepared Off-Site ☐ Field Cleaned
Metals samples field filtered? ☐ Yes ☐ No Method: _____
APPEARANCE: ☐ Clear ☐ Turbid ☐ Color: _____ ☐ Contains Immiscible Liquid
FIELD DETERMINATIONS: See attached form for field parameter data.

DUP : ☐ No ☐ Yes Name: _____

MS/MSD : ☐ No ☐ Yes Name: _____

I certify that this sample was collected and handled in accordance with applicable regulatory and project protocols.

Signature: _____ Date: _____

2 Park Way, Upper Saddle River, NJ 07458
Phone: (201) 574-4700 Fax: (201) 236-1607

NJ FIELD LAB ID# 02023
LOW-FLOW GROUNDWATER FIELD DATA SHEET

[illegible]**Certified Sample Information:**

Time of Sample: _____ Analyst Signature: _____

Instrument Data:

Manufacturer/Model:

Serial No. Unit: _____ Serial No. Handheld: _____

Calibration Date/Time: _____

Are low-flow parameters subject to field lab certification? ☐ Yes ☐ No (not required for CERCLA sites or sites outside of NJ)

If yes, low-flow data must be accompanied by a completed "Field Calibration Record, Horiba U-52" form or equivalent.

APPENDIX I

GENERIC FIELD SAMPLING PLAN

**GENERIC
FIELD SAMPLING PLAN

FOR

SITE INVESTIGATIONS

AT

NON-OWNED FORMER MGP SITES**

Prepared for:

**Niagara Mohawk, A National Grid Company
300 Erie Boulevard West
Syracuse, New York**

Prepared by:

**Foster Wheeler Environmental Corporation
One Park Place
300 South State Street, Suite 620
Syracuse, New York**

NOVEMBER 2002

Site Specific

Revisions Attached: Supplement No. ____ Date ____

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1.0 INTRODUCTION

This generic Field Sampling Plan (GFSP) has been prepared for Niagara Mohawk, a National Grid Company (NM) in response to the Voluntary Cleanup Order (VCO) (Index No. DO 0001 0011) between NM and the New York State Department of Environmental Conservation (NYSDEC). This document is intended to provide guidance for implementation of various types of environmental sampling activities that may be utilized during Site Investigation and/or Remedial Investigations, Interim Remedial Measures, Feasibility Studies, Remedial Designs, and/or Remedial Actions at Non-owned Former MGP sites. The numbers and types of environmental samples to be collected are identified in the detailed respective Site-Specific Work Plans, to which this document is appended. If any discrepancy occurs between the Site-Specific Work Plan and the Generic Work Plan/Field Sampling Plan then the Site-Specific Work Plan will govern.

During the performance of any investigation, references in all work products to dense nonaqueous phase liquids (DNAPL) and/or other MGP impacted media (i.e. soil, water, sediments, etc.) will be made using the terminology and descriptions presented in the U.S.EPA documents entitled *Ground Water Issue - Dense Nonaqueous Phase Liquids* (Huling and Weaver; March 1991) and included as Attachment B.

2.0 GENERAL FIELD GUIDELINES

2.1 Underground Utilities

All underground utilities, including electric, telephone, cable TV, sewers, water, natural gas, etc., will be identified prior to any drilling and subsurface sampling. Underground Facilities Protective Organization (UFPO) will be contacted by phone at least 72 hours prior to field activities so their underground utilities can be marked at the Site. Other potential on-site hazards such as sharp objects, known subsurface structures, overhead power lines, and building hazards will be identified during the Site reconnaissance visit.

2.2 Sample Identification

Each sample will be given a unique identification as shown in Table 1. With this type of identification, no two samples will have the same label. Labels or tags identified as shown in Table 1 will be attached to each sample container. Labels or tags will be rendered waterproof by either covering the label with clear plastic wrapping tape or utilizing waterproof material for the tag or label.

2.3 Sampling Equipment

The following is a general list of equipment, which may be necessary for sample collection:

- Stainless steel spoons and bowls for mixing soil and sediment samples;
- Appropriate sample containers (and coolers) provided by the laboratory;
- Sample bottles (kept closed and in the laboratory-shipped coolers until the samples are collected);
- Reagent-grade preservatives and pH paper or meter (or pre-preserved sample containers) for aqueous samples;
- Chain-of-Custody labels, tags, seals, and record forms;
- Logbook, field sampling records, and indelible ink markers;
- Laboratory grade decontamination detergents (such as Alconox, Liquinox, etc.), reagent-grade solvents, and deionized, organic-free water to be used for decontaminating equipment between sampling stations;
- Squirt Bottles;
- Ruler and measuring tape;
- Garbage bags;
- Paper towels and/or baby wipes;
- Buckets, wash basins, and scrub brushes to be used for decontaminating equipment;

- Digital camera or camera and film to document sampling procedures and sample locations;
- Stakes and flagging tape and/or spray paint to identify sampling locations;
- Shipping labels and forms;
- Knife;
- Vermiculite or other packing/shipping material for sample bottles;
- Strapping tape;
- Clear plastic tape;
- Duct tape;
- Aluminum Foil;
- Reclosable plastic bags;
- Ice;
- Portable field instruments, which may include but not be limited to a pH meter, conductivity meter, turbidity meter, dissolved oxygen (DO) meter or multi-parameter flow through cell, photoionization detector (PID), and water level indicator;
- Combustible gas indicator (CGI);
- Poly-sheeting;
- Driller's jars (for archiving samples);
- Polypropylene or stainless steel bailers;
- Poly propylene rope and/or Teflon line; and
- Submersible, peristaltic and/or centrifugal pump and associated tubing.

Other sampling materials and equipment may be utilized as warranted by field conditions encountered at time of sampling and media to be sampled. Appropriate health and safety equipment and PPE, as per the Generic Environmental Health and Safety (EHS) Plan (Volume II) will be used.

2.4 Field Records

The Project Manager will control all field logbooks. Each field logbook will receive a serialized number and be issued to the field operations leader (FOL). Field logbooks will be maintained by the FOL and other team members while in the field to provide a daily record of significant events, observations, and measurements during the field investigation. All entries will be signed and dated at the bottom of each page.

Information pertinent to the field investigation and/or sampling activities will be recorded in the logbooks. The logbooks will be bound with consecutively numbered pages. Entries in the logbook will include, at a minimum, the following information:

- Name and title of author, date and time of entry, and physical/environmental/weather conditions during field activity;
- Purpose of sampling activity;
- Location of sampling activity;
- Name and address of field contact;
- Name and title of field crew members;
- Name and title of any Site visitors;
- Sample media (soil, sediment, groundwater, etc.);
- Sample collection method;
- Number and volume of sample(s) collected;
- Description of sampling point(s);
- Volume of groundwater removed before sampling;
- Preservatives used;
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- Field observations;
- Any field measurements made, such as pH, temperature, turbidity, conductivity, water level, etc.;
- References for all maps and photographs of the sampling site(s);
- Information pertaining to sample documentation such as:
 - Bottle lot numbers
 - Dates and method of sample shipments
 - Chain-of-Custody Record numbers
 - Overnight Shipping Air Bill Number

All original data recorded in Field Logbooks, Sample Tags, and Chain-of-Custody records will be written with waterproof ink. None of these accountable, serialized documents will be destroyed.

If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a single line through the error, placing the initials of the individual making the correction and date next to the crossed out information and entering the correct information. The erroneous information will not be erased. All field personnel will be instructed as to the proper field logging techniques for maintaining the integrity of the documentation.

3.0 EQUIPMENT DECONTAMINATION

3.1 Drill Rig and Backhoe Decontamination

A decontamination pad will be constructed of high-density polyethylene sheeting, no less than 10-millimeters thick, on a prepared surface sloped to a sump. The sump must also be lined and of sufficient volume to contain at least 20 gallons of decontamination water. The size of the pad shall be of sufficient size to contain the fluids generated during the decontamination of on-site equipment. The decontamination pad will be no larger than the back of the drill rig, since the back of the drill rig will be the largest piece of equipment anticipated on-site. Sides of the pad will be bermed so that all decontamination water is contained. Upon completion of all field activities, the decontamination pad will be properly decommissioned. To accomplish decommissioning, all free liquids will be removed from the surface of the High Density Polyethylene (HDPE) sheeting, including the sump area, and allowed to air dry. The HDPE sheeting will then be cut to manageable size, folded or rolled, and placed in the waste container (usually a roll-off container or 55-gallon drum). The earthen material or wood timbers used to construct the containment berm will be inspected to ascertain if the material has come in contact with decontamination liquids during use. If they have, the materials will be disposed in the waste container for subsequent disposal at an appropriate facility. If the materials have not been in contact with decontamination liquids, they may be reused.

All equipment used in intrusive work including backhoe, drilling rig, augers, bits, tools, split-spoon samplers and tremie pipe will be cleaned with a high-pressure hot water or steam cleaning unit and scrubbed with a wire brush to remove dirt, grease, and oil before beginning field work and before leaving the project Site upon completion of the last sampling activity. All tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be avoided. The back of the drill rig and all augers, rods, and tools will be decontaminated between each drilling location according to the above procedures. The backhoe bucket, arm, and any other part of the equipment, which may have contacted excavated soil, will be decontaminated between each test pit location. Tools, augers, and rods will be decontaminated between drilling monitoring wells.

Decontamination water collected in the sump of the decontamination pad will be at a minimum removed from the sump at intervals less than 90% of its capacity and prior to rain events. The liquids will be pumped to a 55-gallon drum and stored in an appropriate satellite storage area. All waste handling will be performed in accordance with waste handling regulations.

Unless sealed in manufacturers packaging, monitoring well casing and screens will be steam cleaned immediately before installation. The screen and casing shall then be wrapped in polyethylene plastic and transported from the designated decontamination area to the well location.

3.2 Sampling Equipment Decontamination

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Prior to sampling, all non-dedicated/non-disposable equipment (i.e., bowls, spoons, and bailers) will be washed with potable water and a laboratory grade detergent (such as Alconox). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, 55-gallon drums, etc. The sampling equipment will then be rinsed with potable water followed by a reagent-grade isopropanol rinse and finally a deionized water rinse. Additionally, all equipment used to collect samples for metals analysis will receive a nitric acid rinse followed by a deionized water rinse. Between rinses, equipment will be placed on polyethylene sheeting. At no time will decontaminated equipment be placed directly on the ground. Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

4.0 SITE RECONNAISSANCE AND SCREENING

The following practices, procedures and methods will be utilized in carrying out all field activities if specified in the Site-Specific Work Plan.

4.1 Site Reconnaissance

Following the contact with UFPO and markout of subsurface utilities at the Site, Site reconnaissance will be performed. The Site reconnaissance will be attended by the NM Project Manager, the Consultant Project Manager and/or the FOL, and representatives of the NYSDEC and/or the NYSDOH. During this task, the NYSDEC-approved sampling locations, as outlined in the Site-Specific Work Plan, will be marked in the field with a wooden stake and/or spray paint. Conflicts with the NYSDEC-approved sampling locations, based on the utility markout, will be modified during this visit.

Prior to this Site visit, the property owner and/or company representative will be contacted by the NM Project Manager to meet at the Site. The property owner and/or company representative will be asked if subsurface structures exist on the property and will be asked to identify their locations. Subsurface structures will consist, but are not limited to the following: septic tanks, cesspools, underground irrigation lines, water supply wells, vaults, leaching fields, propane, oil, and/or fuel tanks, underground utilities installed by the owner, drainage lines, etc.

4.2 Metal Detector Survey

A metal detector survey may be conducted using the magnetic cable locator model MAC-51B (or equivalent); to locate unidentified underground utilities and possible buried drums or tanks. The area around each proposed subsurface investigation point may be checked with the MAC-51B (or equivalent) prior to any subsurface investigation. Initially, the locator will be tested on known locations of underground utilities to verify that it is functioning properly.

If there is no indication of buried utilities, drums, or tanks, then subsurface sampling will proceed. However, if the locator indicates the presence of a buried object, activities will not proceed in that location until the type of buried object is determined. If the object cannot be identified from surface or shallow digging, a test pit may be required to determine the identity of the buried object. If a test pit is required, the procedure and scope will be reviewed with the NM Project Manager prior to conducting the work.

The NM Project Manager will keep the property owner or company representative informed of planned Site activities.

4.3 PAH Field Screening

PAH screening of soil samples may be used to determine the extent of PAHs in soil and to optimize the location of samples for confirmatory laboratory analysis.

If PAH field screening is conducted at any Site, then adequate facilities will be provided for proper use of the PAH-specific immunoassay test. The individual responsible for conducting the immunoassay test in the field shall receive instruction in the proper use and storage of the test kit. The instructions for the PAH Field Screening Kit are provided as Attachment A of the Generic Quality Assurance Project Plan (QAPP) (Volume II). The test is a simple procedure designed to test any type of soil sample for PAHs. The test uses a semi-quantitative, colorimetric method that incorporates immunoassay technology. The test is performed using tubes, which are coated with a chemical that specifically reacts with PAHs. To perform the test, the standards, samples and reagents are added in a step-wise manner to the coated tubes. The procedure results in a color change within each tube inversely proportional to the concentration of PAHs. The color in the tubes is read by inserting the tubes in a standardized color photometer. The test consists of the following three steps:

1. Sample Preparation: First, PAHs are extracted from the soil using a solvent. The extract is clarified using a disposable 0.45-micron filter tip.
2. Testing: After sample preparation, the PAH standards and the sample and the enzyme are added to the coated tubes. After 10 minutes incubation, the tubes are rinsed and color-developing reagents are added. Within a few minutes, color development occurs in the tubes.
3. Results Interpretation: The color of the sample tube is compared against the color of the standard tube using a photometer to determine if PAHs are present in the sample. The result will indicate concentrations in three ranges; less than 1 ppm, between 1 and 100 ppm, and over 100 ppm.

4.4 PCB Field Screening

Polychlorinated biphenyls (PCBs) screening of soil samples may be used to determine the extent of possible PCBs in soil and to optimize the location of samples for confirmatory laboratory analysis. The field screening may be conducted using a PCB-specific immunoassay test. The individual responsible for conducting the immunoassay test in the field shall receive instruction in the proper use and storage of the test kit. The instructions for the PCB Field Screening Kit are provided as Attachment A of the Generic Quality Assurance Project Plan (QAPP) (Volume II). The test is a simple procedure designed to test any type of soil sample for PCBs. The test uses a semi-quantitative, colorimetric method that incorporates immunoassay technology. The test is performed using tubes, which are coated with a chemical that specifically reacts with PCBs. To perform the test, the standards, samples and reagents are added in a step-wise manner to the coated tubes. The procedure results in a color change within each tube proportional to the concentration of PCB. The color in the tubes is read by inserting the tubes in a comparative photometer. The test consists of the following three steps:

1. Sample Preparation: First, PCBs are extracted from the soil using a solvent. The

extract is clarified using a disposable 0.45-micron filter tip.

2. Testing: After sample preparation, the PCB standards and the sample are added to the coated tubes using dropper bottles. After 10 minutes incubation, the tubes are rinsed and color-developing reagents are added. Within a few minutes, color development occurs in the tubes.
3. Results Interpretation: The color of the sample tube is compared against the color of the standard tube using a photometer to determine the concentration of the sample. The result will indicate concentrations in 3 ranges; less than 5 ppm, between 5 and 50 ppm, and over 50 ppm. Also, with a dilution samples can be tested for over 500 ppm.

PCB specific screening with the eminas test kits will be utilized on-sites, which have historically been associated with either electrical equipment from a certain time period that employed the use of PCB oils or when records may reflect the use of PCBs at that facility. The test kits will be used as part of an overall analytical program, which will include laboratory analysis of on-site soils.

4.5 Private Water Supply Inventory

If off-site groundwater impacts are detected through the sampling program, or if specifically requested by the NYSDEC, than an inventory of private water supply sources within a one-half mile radius around the project Site will be researched. The research will be conducted by contacting the municipal Water Department (if one exists), the municipal engineer, the NYS Department of Health and consulting the *Atlas of Community Water System Sources*, and/or the United States Geologic Society (USGS).

5.0 SUBSURFACE BORING PROTOCOL

5.1 Drilling Methods and Sample Collection

Overburden

Soil borings, in general, will be drilled with hollow-stem augers or flush-joint casing. When advancing a soil boring, re-entry of the split-spoon sampler into the previously sampled interval shall not be permitted. Hollow-stem augers with center plug will be advanced at two-foot intervals, consistent with the split-spoon sampling pace. Alternative methods may be used at the geologist's discretion with the authorization of NM and NYSDEC. Split-spoon sampling will be conducted in accordance with ASTM Specification D-1586-84 for standard penetration test and split barrel sampling, unless otherwise authorized by the field geologist. Split-spoons will be decontaminated after each sample is collected.

A plywood sheet or other suitable basin (during mud or water rotary drilling) will be placed around the augers during drilling to contain soil cuttings/mud drilling and prevent them from contacting the ground surface. Soil cuttings will be placed in a 55-gallon steel drum or a roll-off container for subsequent sampling and disposal. Decontamination water and drilling mud/water will be placed in tanks and/or 55-gallon steel drums for proper disposal.

Boring Completion Methods

All soil borings will be completed by adding cement/bentonite grout, via tremie pipe, from the bottom of the borehole up to the ground surface as the augers are withdrawn. The grout will be mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite.

Geoprobe® Coring

If prescribed in the Site-Specific Work Plan, Geoprobe® coring will be performed in accordance with the manufacturer's specifications. An assembled Geoprobe Macro-Core® open-tube soil sampler, with a one use dedicated liner, will be driven one sampling interval (approximately 4 feet) into the subsurface then retrieved using a Geoprobe® soil probing machine. The collected soil core will be removed from the sampler along with the liner. The field geologist will classify and sample the soil located within the liner. Upon completion, the excess soil will be placed into a 55-gallon drum for disposal and the inner liner properly disposed. After decontamination, the Macro-Core sampler will be reassembled using a new liner. The clean sampler will then be advanced back down the same borehole to collect the next soil core interval.

Upon completion of sampling, the borehole will be grouted from the base of the borehole to ground surface. As the Geoprobe® piping is removed from the borehole, grout will be placed in the Geoprobe® piping and allowed to flow out, via gravity, into the void left by the piping.

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Procedures for geologic logging and field classification will be as presented in Section 5.2.

Shelby Tube Sampling

Shelby tube samples will be collected in accordance with the latest revision of ASTM D/587. When the desired sampling depth is reached, the hollow-stem auger or casing will be cleaned out using whatever method is preferred so as not to disturb the material to be sampled. The Shelby tube will be lowered to the bottom of the borehole, then advanced (pushed) via pressure without rotation by a continuous relatively rapid motion until 24 inches of penetration is achieved. At the discretion of the field geologist, a period of approximately 10 minutes, measured from the time of insertion, will be allowed to provide for sample adhesion to the tube walls. Prior to removal, the tube may be rotated two complete revolutions to shear the bottom of the sample from the native material.

Upon removal, the field geologist will log the tops and bottoms of the sample for soil classification. Samples recovered via Shelby tube will be preserved in conformance with the latest revision of ASTM D 4220. To preserve the natural moisture content of the samples, the tube ends will be sealed with a minimum of 0.50 inch of paraffin wax. Plastic slip caps will be applied at the ends of the sample tube, taped, then dipped and sealed in wax.

Rock Coring

Conventional or wire-line HX or NX coring will be used if rock drilling is specified in the Site-Specific Work Plan. Prior to drilling at such locations, a minimum 4-inch diameter, temporary steel casing or equivalent will be placed or locked into the top of bedrock. Rock coring will be conducted in accordance with the latest version of ASTM D2113. Upon retrieval, the core will be placed in a core box labeled as follows:

Outer Core Box and/or End Panels

- 1) Project/Site name
- 2) Site location
- 3) Boring/well number
- 4) Box number
- 5) Core run number and footage interval
- 6) Date

Inside Core Box Cover (in columns)

- 1) Boring/well number
- 2) Run number
- 3) Depth interval
- 4) Actual recovery
- 5) Rock quality degree (RQD) in percent
- 6) PID screening results where applicable

7) Comments

In addition, a geologist will be on-site during the drilling operations to fully describe each core, including:

- 1) Color
- 2) Thickness of bedding
- 3) Rock type
- 4) Additional petrographic information
- 5) Texture
- 6) Weathering state
- 7) Structure
- 8) Detailed description of discontinuities and fillings
- 9) Formation name
- 10) Detailed description of visible impacts
- 11) Miscellaneous observations

Sample descriptions, PID readings, and drilling locations will be recorded in the field logbook.

5.2 Geologic Logging, Soil Classification and Documentation

The field geologist will log borehole geology in the field logbook and on field forms. All samples collected from the borehole will be classified in accordance with ASTM standards D2487 Standard Method for Classification of Soils for Engineering Purposes and D2488 Standard Practice for Description and Identification of Soils or using the Burmeister Method and classifying the soils using the Unified Soil Classification System. The field geologist will be on-site during the drilling operations to classify/log each sample in the field logbook and/or field forms including:

- Site;
- Boring number;
- Interval sampled;
- Date;
- Initials of sampling personnel;
- Drilling Company's Name;
- Soil type;
- Color;
- Feet of recovery;
- Moisture content;
- Texture;

- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

If no recovery, or limited recovery, is observed in the sample, then a description regarding the lack of sample recovery should be provided on the log of boring, if evidence of an obstruction or equivalent can be identified. If no observable evidence is identified then no opinion or guess should be entered on the log of boring.

Figure 1 presents an example of a log of boring form to be completed. If this form is not utilized, the form used should be approved by the Consultant's Project Manager as well as NM's project manger.

Photo documentation

Photo documentation of the Site activities will be conducted consistently throughout the implementation of the field program. A photographic log will be created and maintained as part of the overall field program. Visually impact materials and/or distinct stratigraphic changes in the soil column will be included in the photographic documentation for the individual Sites.

6.0 MONITORING WELL INSTALLATION AND DEVELOPMENT

Monitoring wells will be installed at the locations identified in the Site-Specific Work Plan. After the completion of drilling and monitoring well installation, all wells will be developed prior to the collection of groundwater samples. The following procedures will be used to install and develop all monitoring wells.

6.1 Monitoring Well Specifications

Monitoring wells installed in unconsolidated deposits that do not penetrate a presumed confining layer will be constructed according to the following specifications:

- PVC or stainless steel 2-inch diameter threaded, flush-joint casing and screens with O-rings will be installed.
- Wells will be screened in the unconsolidated deposits. Screens will be approximately 10 feet in length, and slot openings will be 0.020 inch. Alternatives may be used at the discretion of the field geologist, based on Site-specific geologic conditions.
- A sump, up to 2 feet in length, may be attached to the bottom of the screen to collect dense nonaqueous phase liquids (DNAPLs), if appropriate. A sump will not be installed if DNAPL is not observed in the boring.
- The top of the casing will extend to approximately 2 to 3 feet above ground surface where possible, given Site-specific considerations. Otherwise, flush-mount casings will be used.
- Where appropriate, the annulus around the screens will be backfilled with silica sand (#1 Morie or equivalent), based on Site-specific geologic conditions and screen slot size, to a minimum height of 2 feet above the top of the screen.
- A bentonite pellet/chip seal or slurry (30 gallons water to 25 to 30 lbs. bentonite, or relative proportions) will be placed above the sand pack. The bentonite pellet/chip seal will be installed via gravity and allowed to hydrate for at least 1 hour before placement of grout above the seal. If the bentonite slurry method is used for installation of the seal, then a side discharging tremie pipe will be utilized for the installation of the bentonite seal. Where possible, the bentonite seal will be a minimum of 24-inches in depth, except in those instances where the top of the well screen is in close proximity to the ground surface. In these instances, the well will be completed in accordance with specifications provided by the field geologist, which will incorporate an adequate surface seal into the well design.
- A fine sand pack (Morie 00 or equivalent) approximately 1 foot thick will be placed above and below the bentonite seal to isolate it and to prevent mixing of components.
- The remainder of the annular space will be filled with a cement-bentonite grout up to the ground surface. The grout will be pumped from the bottom up. The grout will be

mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite. The grout will be allowed to set for a minimum of 48 hours before wells are developed.

- Each monitoring well will have an expansion plug or plumbers plug and a 4-inch diameter, steel casing with a hinged, locking cap placed over the monitoring well. The protective casing will extend approximately 2 feet below ground surface and be cemented in place. In some areas, it may be necessary to provide flush mounted casings. All wells will have keyed-alike locks and the keys will be maintained by the NM project manager.
- A concrete surface pad (2 ft x 2 ft x 6-inch) will be sloped to channel water away from the well casing.
- A weep hole will be drilled at the base of the protective standpipe casing to allow any water between the inner and outer casing to drain. If a flush mounted protective casing is installed then a small diameter drainage tube will be installed in the side of the casing discharging to the surrounding subsurface soils.
- The flush mounted monitoring well protective casing will be a minimum 8-inch diameter box or equivalent. All flush mounted well risers will be capped with an expansion plug or plumbers plug.
- The top of the PVC well casing will be permanently marked/notched and surveyed to 0.01 foot, and elevations will be determined relative to a fixed benchmark or datum. The measuring point on all wells, the permanent mark/notch will be on the innermost PVC casing.
- Each outer casing will be permanently labeled using a steel hand stamp or equivalent (i.e. MW-4).

Modification of the above installation procedure will be subject to changes in the field. All field-executed changes will be communicated to the NYSDEC for their discussion and approval, if appropriate.

Based on field conditions and evaluation of the best methodology to ensure the integrity of the seal, the field geologist will select the best method (i.e. bentonite pellet via gravity or bentonite slurry via tremie) to install the bentonite seal above the sand pack.

Figure 3 shows details of an overburden monitoring well construction diagram for wells installed in unconsolidated material. Figure 2 shows details of a monitoring well installed with a flush mounted protective casing.

Figure 4 shows details of a typical double-cased monitoring well construction diagram for wells installed in unconsolidated soils that do penetrate a presumed confining layer. The decision to install double-cased wells will be made on a boring-specific basis by the field geologist. Double-cased wells will be installed when the boring for the monitoring well penetrates a presumed confining layer. The

confining layer shall be defined as a minimum five (5) foot thick, predominantly clay unit which has been shown to be laterally continuous across the Site. In the event the field geologist and NM and NYSDEC Project Managers decide a reasonable possibility exists for contamination to be deposited in deeper, clean zones during the drilling and installation of a monitoring well, the well will be double-cased. The purpose of the steel protective casing will be to minimize the possibility that residual contamination is deposited at the depth of the screened interval during the drilling process.

Monitoring wells that penetrate confining layers will be installed according to the following specifications:

- 6-inch inside diameter (ID) steel outer casings will be installed to a depth of at least 2 feet below the lower limit of observed or measured contamination and/or the confining layer. This casing will be grouted in place with cement to inhibit downward migration of contamination.
- The 6-inch casing will be installed through 6.25-inch ID hollow-stem augers. The augers will be filled with grout prior to their removal to ensure the integrity of the borehole and the grout seal. Then, the 6-inch casing will be installed into the grout and hydraulically pushed approximately 1-foot beyond the bottom of the boring. A 3-foot thick grout plug will be installed at the base of the 6-inch diameter pipe through which the borehole will be advanced. Potable water will be tremied to the bottom of the inside of the casing to dilute the grout, thereby allowing the grout to be more easily pumped out of the casing. The grout, pumped out of the casing, will be drummed and staged with other investigation-derived waste (IDW).
- The cement-bentonite grout remaining in the annulus between the casing and the formation will be allowed to set for at least 24 hours before drilling is continued. The drilling will then continue using 4-inch diameter flush-joint spin casing and potable water. All lubricant water will be containerized.
- The well will be constructed of 2-inch diameter PVC or stainless steel riser pipe and screen, sand pack, bentonite seal, grout, and surface casing as specified for single cased monitoring wells discussed above and in accordance with NYSDEC requirements. The bentonite seal may consist of pellets or a bentonite slurry mixture in proportions relative to 30 gallons of water to 25-30 pounds of bentonite. The grout mix will consist of 30 gallons water to three 94-pound bags of cement and 25 pounds of granular bentonite.

Monitoring wells to be installed as open holes in bedrock will be installed according to the following specifications:

- Advance each boring to the top of the bedrock surface. Borehole advancement will be conducted using 6¼-inch inner diameter (ID) continuous flight hollow-stem augers in 2-foot intervals, to permit the continuous collection of subsurface soil samples with carbon steel split-spoon samplers in accordance with Section 5.1. Confirmation of the

bedrock surface depth will be based upon split-spoon and hollow stem auger refusal.

- Overbore the borehole to a 12-inch diameter borehole, in which to install a temporary 10-inch carbon steel overburden casing to bedrock, utilizing an appropriately sized tri-cone roller bit or thin wall bit. A 3-foot thick grout plug will be installed at the base of the 10-inch diameter pipe through which the borehole will be advanced, if appropriate.
- Subsequent to temporary casing installation, continue borehole advancement into the bedrock to a depth of 5 feet below the bedrock surface, first using the rock coring method for logging (see Section 5.1) and then overboring with a 9-inch outer diameter (OD) tri-cone roller bit via the water rotary method.
- Set a permanent 6-inch carbon steel casing 5-feet into the competent bedrock by the spin casing method.
- Backfill the annular space around the well casing with bentonite/cement slurry to the surface. The ratio of cement to bentonite for grouting will be approximately 30 gallons of water to three 94-pound bags of cement to every 25 pounds of granular bentonite.
- Remove the 10-inch temporary casing during pressure grouting. Allow grout to cure for at least 24 hours.
- Continue coring and then drilling in the borehole to the maximum anticipated total depth (i.e. 10 feet below the point where groundwater was encountered) and/or the depth where fracture zones indicate sufficient yield, first using the rock coring method and then overboring utilizing the water rotary method and a 5-inch OD tri-cone roller bit or equivalent.
- Complete the open hole monitoring well with a protective locking stick-up or flushmount box installed in a concrete pad as per Section 6.1.
- If the borehole extends to a depth greater than 25 feet below the bottom of the surface casing (due to depth and/or yield of groundwater), construct the monitoring well using 10 feet of 2-inch diameter Schedule 40 PVC or Schedule 5 stainless steel wire wound screen (0.010-inch slot or a slot size appropriate to the formation) and 2-inch diameter Schedule 40 PVC or Schedule 5 stainless steel riser pipe. For non-flushmounted wells, at least 2 to 3 feet of riser pipe must extend above the ground surface. Flushmounted wells will only be installed in high traffic areas, such as roadways, sidewalks, etc.
- Backfill the annular space to a minimum height of 2 feet above the top of screen with a sand pack. The sand pack shall be Morie #1 silica sand or equivalent (based on Site-specific geologic conditions and screen slot size). The remaining annular space will be filled with bentonite/cement grout up to the ground surface. The ratio of cement to bentonite for grouting will be approximately 30 gallons of water to three 94-pound bags of cement to every 25 pounds of granular bentonite.

- Complete the constructed monitoring well as described with a protective locking stickup or flushmount box installed in a concrete pad as per Section 6.1.

Modification of the above installation procedure will be subject to changes in the field. All field-executed changes will be communicated to the NYSDEC for their discussion and approval, if appropriate.

Characteristics of each newly installed well will be recorded on the appropriate well construction diagram. Each well will be identified with a well number placed on the inside of the well cap and on the outside of the protective casing or outside flush-mount cover. Each separate source of potable water used for the drilling process will be sampled once for TCL/TAL compounds.

6.2 Monitoring Well Development

After a minimum of 24 hours after completion, the monitoring wells will be developed by one or a combination of the following techniques:

- Surging;
- Bailing;
- Using a centrifugal pump and dedicated polyethylene tubing;
- Positive displacement pumps and dedicated polyethylene tubing, and/or
- Other methods recommended by the field geologist and approved by the NM and NYSDEC Project Managers.

Development water will initially be monitored for organic vapors with a PID. In addition, the development water will be observed for the presence of non-aqueous phase liquids (NAPLs) or sheens. The development water will be contained in a tank and/or 55-gallon steel drums on-site. The purge water will be disposed of in accordance with NYSDEC requirements. The wells will be developed until the water in the well is reasonably free of visible sediment (<50 NTU if possible) or until pH, temperature and specific conductivity stabilize, assuming a minimum of 10 well volumes of water has been removed from the monitoring well during development. In no case will well development exceed 8 hours per well. Following development, wells will be allowed to recover for at least one week before groundwater is purged and sampled. All monitoring well development will be overseen by a field geologist and recorded in the field logbook.

6.3 In-Situ Hydraulic Conductivity Testing

In-situ hydraulic conductivity testing may be performed on selected monitoring wells as indicated in the Site-Specific Work Plan to obtain estimates of groundwater velocities and potential groundwater recovery rates for the aquifer. The objective of the hydrogeologic testing is to determine the hydraulic properties of the aquifer in the vicinity of the Site.

Slug tests may be conducted in selected monitoring wells utilizing the rising or falling head slug test technique. Rising head tests can be performed in unconfined and confined aquifers. Falling head tests

should only be performed in confined aquifers. The slug tests will be performed by subjecting water-bearing units in the screened interval to a stress caused by the sudden displacement of the water level within the well. The rising head tests will be conducted as follows:

- Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 3.2.
- Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electric sounder (water level indicator) and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
- A weighted slug of known volume will be inserted gently into the well below the water table. The water level will be measured until the water level returns to static conditions.
- The slug will be suddenly withdrawn from the well and the water level recovery will be monitored at appropriate intervals until recovery is complete and stabilized.
- Wells, which were bailed dry during development, may not be able to provide meaningful data through slug tests. Tests will be terminated in wells which do not recover significantly (>80% of static level) within a certain amount of time, at the discretion of the field geologist. These wells will be bailed dry and their recovery measured with an electronic water level indicator.

The falling head tests will be conducted as follows:

- Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 3.2.
- Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electronic sounder (water level indicator) and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
- A weighted slug of known volume will be quickly inserted into the well below the water table. The water level will be measured until the water level returns to static conditions.
- The test will be terminated in wells which do not recover significantly (>80% of static level) within an unspecified time, at the discretion of the field geologist.

The slug test data will be analyzed using the Cooper, Bredehoeft, and Papadopoulos (1967) type curve method or the Bouwer and Rice (1976, 1989) method. The Cooper et al. analysis assumes that the well penetrates a confined aquifer, and the Bouwer and Rice method applies where unconfined conditions are prevalent.

6.4 Well Abandonment

Monitoring wells installed in unconsolidated material will be abandoned in the following manner:

- Remove the protective casing and concrete pad.
- Over drill the well casing using hollow-stem augers or casing to at least one foot below the depth of the boring/well as indicated in the soil boring log.
- Remove the well casing from the hole. If the casing cannot be removed while the augers are in place, cutoff the casing at least two feet, and if possible five feet, below the ground surface.
- Add cement/bentonite grout via tremie pipe from the bottom of the augers as the augers are withdrawn.
- If the well casing cannot be overdrilled and removed, the well casing will be filled with cement/bentonite grout from the bottom up using a tremie pipe. The grout mixture will be as specified for the well installation (see Section 6.1).
- Add grout to the point where the casing was cut off. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

Monitoring wells installed in Consolidated (bedrock) or open holes will be abandoned in the following manner:

- Remove the protective casing and concrete pad.
- Add cement/bentonite grout via tremie pipe from the bottom of the well up to the ground surface. The grout mixture will be as specified for the well installation (see Section 6.1). □
- Add grout to the point where the casing was cut off. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

6.5 Packer Testing

Attachment A presents the packer test procedures to be used in the event the hydraulic conductivity of a discrete bedrock zone is required for the purpose of determining the well screen interval of bedrock wells. Down-hole packer equipment will be decontaminated following the procedures in the FSP (see Section 3.1) prior to use at each location and prior to demobilization.

7.0 TEST PIT EXCAVATIONS

When specified in the Site-Specific Work Plan, test pits will be excavated using a rubber-tired or track backhoe. In the event deep excavations are anticipated, a track hoe will be utilized. Locations of test pits, if proposed in the Site-Specific Work Plan, will be finalized in the field, based on the location of potential source areas and existing underground utilities. If the prospective test pit location is covered by asphalt or concrete, the area will be saw cut prior to excavation. During excavation activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring will be conducted in accordance with the Generic EHS Plan (Volume II). Test pit materials will be logged, as well as photographed for future reference. Material removed from the test pit will be placed on polyethylene sheeting. Should sampling of excavated material be performed, samples will be collected with a decontaminated or a new disposable sampling tool, or equivalent, from the center of the backhoe bucket. Upon completion, the material from the test pit will be placed back in the excavation in the reverse order in which it was excavated. The location and size of the test pit will be measured and described in the field logbook.

Visually clean soils, such as surface soils, will be segregated from soils that may be impacted. The visually clean soils will be used to cover the impacted soils/source materials when placed back in the excavation. At a minimum, the top two feet of back filled soil will be visually clean. If the original (top) two feet of soil is impacted or some portion of it is impacted then the soil will be replaced and/or supplemented with certified clean fill. Test pits will be backfilled as soon as possible after completion and in general prior to the cessation of activities at the end of the day. The closure of individual test pits, prior to work cessation at the end of the day, will be performed on a case by case basis utilizing criteria for the maintenance of safe working and overall Site conditions. For gravel roadways and parking areas, the backfill will be tamped down in 18-inch lifts. A 6-inch layer of clean run-of-crush gravel will be tamped in-placed as the final lift. For test pits located in asphalt-covered areas, the surface will be replaced with cold or hot asphalt mix, compacted by rolling, and trimmed flush with the adjoining surface. Test pits located in grass covered areas will be returned to original grade and reseeded. Following restoration of the excavation, the test pit will be staked/marked to facilitate subsequent location by surveying crews.

7.1 Underground Utilities

Potential for encountering underground utilities is part of any subsurface investigation, where test pitting will be utilized as part of the investigation. When performing test pitting in areas of suspected live underground utilities, the test pits will be advanced by hand digging to a depth of five (5) feet below ground surface to confirm the location of the live utility. If investigation of abandoned underground utilities is required, then the parameters of the investigation will be specified in the Site-Specific Work Plan.

If an abandoned under ground pipe/structure, associated historically with the former MGP operations, is encountered during the test pitting operation, then excavation activity will cease until the pipe or underground structure can be adequately investigated. The investigation of the piping will include the

description of the pipe/structure construction, material, condition, orientation, dimension, and contents of the pipe/structure, if possible. If the piping/structure interior can not be readily accessed then penetration of the underground utility may be necessary. Penetration of any underground utility should be conducted with the utmost care and consideration given for the utilization of proper tools (spark proof, beryllium coated, etc) for the task at hand. Once the interior of the pipe is accessible then a sample will be taken of the pipe contents, and sent to a laboratory for analysis.

If prior to initiation of test pitting activities, a live underground utility is identified in the area of anticipated test pitting, then the live underground line, if feasible, will be shut down. Consideration must be given to impacts to the facility operations prior to shutting down any active utility. (See the lockout tag out procedure section of the Generic HSP).

If during test pitting activities an unexpected live underground utility is encountered, excavation will cease, the orientation and dimensions of the underground utility will be recorded, and if possible, the live utility will be shielded from damage and test pitting will continue. If shielding is not possible then the test pit will be back filled and a new test pit attempted in the general vicinity of the initial location. When performing excavation activities next to a live underground utility, care will be taken not to undermine or impact the operation of the live underground utility. If a pipe or underground utility is accidentally severed, the owner of the utility, then NM, will immediately be notified. Liquid flows or electricity will be shut off immediately and appropriate repairs initiated as soon as possible. If a release of liquid occurs, the Consultant PM will notify NM who will then notify NYSDEC. All appropriate response actions will be implemented.

8.0 GROUNDWATER SAMPLING

The following is a step-by-step sampling procedure to be used to collect groundwater samples from the monitoring wells. Well sampling procedures will be recorded on the form shown in Figure 5. Sample management is detailed in the Generic QAPP (Volume II).

- Groundwater samples will not be collected until, at minimum, one week following well development.
- Prior to sampling, measure the static water level from the surveyed well elevation mark on the top of the PVC or stainless steel casing with a decontaminated water level probe. The elevation of nearby surface water bodies will also be recorded using bulkheads, culverts, or other convenient structures as reference points in which the elevation is known. These relative measurements will be used to aid with interpreting the relationship between observed surface water and groundwater fluctuations. Record time, date, and measurement to nearest 0.01 foot and record in the field logbook.
- Decontaminate all field test equipment and meter probes prior to use on-site.
- Prior to collecting a round of groundwater elevations an oil/water interface probe will be used to determine the presence of LNAPL and DNAPL in the well.
- A round of groundwater elevations will be collected prior to the start of sample collection. The measurement at each well location will be made from the top of the PVC or stainless steel casing with a water level probe. The measurements will be made in as short a time frame as practical to minimize temporal fluctuations in hydraulic conditions.
- Place a plastic sheet on the ground to prevent contamination of the bailer rope and/or the tubing associated with the purging (pump) equipment.
- Purge the well by removing a minimum of 3 well volumes or at least one volume of saturated sand pack, whichever is greater or use the low flow sampling procedures below. Purging will be conducted with a teflon, stainless steel or disposable polyethylene bailer, or a centrifugal, submersible, peristaltic, or whale pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist, and with the prior approval of NM and NYSDEC. Purging of the well to stabilized parameters may be performed at between 100 to 500ml/min. If the well goes dry before the required volumes are removed, the well may be sampled when it recovers sufficiently.
- Collect volatile organic analyte (VOA) or BTEX samples with Teflon, stainless steel or dedicated polyethylene bailers lowered by a dedicated polypropylene and/or Teflon line or other methods as indicated. TCL SVOCs, PAHs, pesticide/PCBs, TAL metals, natural attenuation parameters, and other non-conventional parameters may be collected with Teflon, stainless steel, or dedicated polyethylene bailer or a

submersible, or peristaltic pump using the low-flow sampling technique. Low flow well sampling will be at a rate less than or equal to 100ml/min.

Low-flow sampling procedures may be utilized to collect samples for metals analysis if sample turbidity is excessive. Low flow sampling will be performed according to USEPA (1998) guidance. The pump should be capable of throttling to a low flow rate suitable for sampling.

- Measure temperature, pH, turbidity, DO, and conductivity, at 5 to 10 minute intervals. When the parameters stabilize over 3 consecutive readings, sampling may commence. Record results in the field logbook prior to sample collection.
- Fill sample containers for VOCs or BTEX first. Sample containers for SVOCs and other analytes are then filled.
- After all samples are collected, dispose of polypropylene line and bailer, or other dedicated disposable sampling equipment.

9.0 SURFACE WATER SAMPLING

Surface water samples will be collected at the locations indicated in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). A decontaminated stainless steel or glass cup may be used to collect the water for these samples or the sample bottles may be directly dipped into the water. At no time will a sample jar, which contains preservative, be submerged in the sampling media. The sample should be collected from mid-depth by submersing the sampling device or sample container to a mid-depth position and opening the container and allowing it to fill. If this methodology does not work effectively then an alternative sampling device (i.e. bacon bomb etc) can be utilized. The stainless steel or glass cup will be decontaminated following the procedures outlined in Section 3.2. Surface water samples will be collected downstream first, and then progressing in an upstream direction. If sediment sampling is to be performed in conjunction with surface water sampling at corresponding locations, the surface water sample will be collected prior to the sediment sample.

Surface water flow measuring techniques will vary greatly based upon the existing field conditions. A discussion regarding the investigative techniques for collection of surface water flow measurements will be discussed in detail in the Site-Specific Work Plan.

All Field data will be recorded in the logbook and on the sample log sheet (Figure 6).

10.0 SURFACE SOIL SAMPLING

Surface soil samples will be collected at the locations indicated in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). Samples will be collected using decontaminated stainless steel equipment or disposable sampling equipment. If the selected sampling location is in a vegetated area, the vegetation will be removed over a one square foot area prior to sample collection. The sample will be collected from within the top 2-inches of the exposed ground surface. Samples will be collected by hand digging into the soil with a pre-cleaned stainless steel trowel or a disposable sampling tool. All samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory. Sample containers for volatile organic analysis will be filled first. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated steel trowel or disposable scoop. This composite sample will be analyzed for all remaining parameters identified in the Site-Specific Work Plan.

All samples collected for analysis will be placed immediately into laboratory sample jars and properly stored in a cooler with ice to 4°C before transport to the laboratory.

Duplicate samples will be collected at the frequency detailed in the Generic QAPP by alternately filling two sets of sample containers. Composite samples may be required to obtain a sufficient soil volume.

In addition, surface soil samples will be described by including:

- Site;
- Location number;
- Interval sampled;
- Date;
- Initials of sampling personnel;
- Soil type;
- Color;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

11.0 SUBSURFACE SOIL SAMPLING

11.1 Samples for Laboratory Analysis

Subsurface soil samples selected for laboratory analysis will be obtained from a standard 2-foot split-spoon or Geoprobe ® samplers and placed in the appropriate containers provided by the laboratory. The soil samples will be collected from the 2-foot sampling interval (assuming full recovery) of the split-spoon. Additionally, the Geoprobe ® methodology will utilize the standard 2-foot sampling interval. Sample containers for volatile organic analysis will be filled first. Samples for volatile analysis will be collected or biased toward the collection of that portion of the sample that exhibits the highest PID reading or as otherwise detailed in the Site-Specific Work Plan. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated stainless steel trowel or disposable scoop.

All samples collected for analysis will be placed immediately into sampling containers provided by the laboratory and properly stored on ice to 4°C before transport to the laboratory. Sample management is detailed in the Generic QAPP (Volume II). In addition, a geologist will be on-site during the drilling operations to fully describe each sample including:

- Soil type and sorting;
- Color;
- Feet of recovery;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations.

Duplicate samples will be collected at the frequency detailed in the Generic QAPP by alternately filling two sets of sample containers.

11.2 Geotechnical Testing

When identified in the Site-Specific Work Plan, laboratory geotechnical testing will be performed on selected soil samples in accordance with appropriate ASTM standards. Geotechnical analysis will be performed on soil samples collected in Shelby tubes or in glass sampling containers including, but not limited to, the following tests: grain size and sieve analysis, total organic carbon, permeability, specific gravity, Atterberg Limits, porosity, moisture content, and bulk density.

12.0 SEDIMENT SAMPLING

Proposed sediment sampling locations are identified in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). Sample locations in surface waterways will be marked along the bank prior to sampling. For all sample locations, the distance from the waterline to the sample location will be measured and recorded in the field logbook. Sediment samples will be collected from the furthest downstream point, progressing toward the furthest upstream sampling location. Following the completion of sampling the sediment locations will be marked along the shoreline for subsequent location by a survey crew.

12.1 Shallow Sediment Samples

Shallow sediment samples collected in shallow water will be collected with a Wildco core sampler, clam shell, lexane tubes, hand auger, vibracore or split-spoon sampler. Where possible, rocks and vegetative material will be discarded, and care will be taken to retain fine materials, which tend to disperse when disturbed. Sampling personnel will stand downstream of the sampling point to minimize disturbance of the bottom sediments during collection. Equipment will be decontaminated between samples following procedures outlined in Section 3.2. Field data will be recorded on the field sampling records. Surface sediment samples will be collected from a depth interval of 0 to 6 inches (0 to 15 cm) using these same procedures as outlined above. Sediments, which are located near shore and are not submerged, will be collected with a decontaminated trowel or disposable sampling tool.

12.2 Deep Water Sediment Samples

Sediment sampling in deeper water and samples requiring retrieval from deeper depths will be obtained using a barge-mounted drilling system or similar watercraft. Either a tripod and cat-head assembly or a Vibracore system will be used on the barge to advance the sampling apparatus into the bottom sediments. The tripod and cat-head assembly will be equipped either with a five-foot long "California" split-spoon sampler or a standard 2-foot long split-spoon sampler for sample collection. Split spoon samplers can be fitted with a sediment sampling head or shoe to ensure adequate recovery of the sample. To keep the hole open for subsequent samples and to minimize cross-contamination, 3-inch spin casing will be advanced, with plug, into the sediment. The spin casing will be advanced in 2-foot increments prior to sampling. The sediment sampler will then be pushed ahead or below the base of the 3-inch spin casing. The spin casing will be pumped free of sediment after each sample is collected. When the casing is free of sediment, it will be advanced 2 additional feet in preparation for the next sample collection.

The Vibracore uses a vibrating motion to advance a barrel and flexible plastic liner to achieve sample collection. A "core catcher" retains the sediment sample upon retrieval. Samples will be obtained by cutting the plastic liner longitudinally using a knife, then the sediment samples will be placed in sampling jars, based on sampling interval compensating for compression.

Sediment samples will be visually classified for texture and screened for the evolution of organic vapors with a PID. Samples will be collected or biased toward the collection of that portion of the sample that exhibits the highest PID reading or as otherwise detailed in the Site-Specific Work Plan. The sediment samples will be collected from the 2-foot sampling interval (assuming full recovery) of the split-spoon. Visible staining or contamination will be noted in the field logbook.

12.3 Sediment Probing

When identified in the Site-Specific Work Plan, sediment probing will be utilized to evaluate the presence of NAPL in the stream bedding. The near-shore sediment probing will be performed on a Site by Site basis. The use of standard visual observance techniques to evaluate the possible presence of sheens on the adjacent water bodies, with out disturbance of the sediments, will be conducted as part of the initial Site Investigation. The Sediment probing activities can be used to supplement the information collected during the initial Site investigation by focusing the probing activities in the area of the observed sheens.

Implementation of a sediment probing investigation will involve the use of multiple sections of 3/8-inch to 1/2-inch threaded rod and associated threaded female couplings. The threaded rod will be pushed into the sediment at multiple locations in an attempt to disturb the near surface sediments as well as deeper sediments. Upon detection of any sheen a stake will be located along the shoreline to provide a marker for the subsequent location by a survey crew, if require by the Site-Specific Work Plan. Sediment probing can also be used to provide information on the depth of competent material below the soft surface sediments.

Personnel will stand downstream of the sampling point to minimize disturbance of the bottom sediments prior to utilizing the probe. Equipment will be decontaminated prior to use in the stream and post use, following procedures outlined in Section 3.2. Field data regarding the location, depth, odor, and description of the sheen will be recorded on the field logbook.

Sediment probing in deeper water and samples requiring retrieval from deeper depths will be obtained by utilizing a rowboat or similar watercraft.

13.0 AIR MONITORING

13.1 Ambient Air Monitoring

Air monitoring will be conducted with a photoionization detector (PID) and combustible gas indicator (CGI) during all drilling and intrusive activities. The PID will be used to monitor for organic vapors in the breathing zone, borehole, and along the Site's perimeter and to screen samples for analysis. The CGI measures the concentration of combustible gas or vapor in air, indicating the results as a percentage of the lower explosive limit (LEL) of the calibration gas. Action levels are identified in the Generic EHS Plan (Volume II).

PID and CGI readings will be recorded in the field logbook and on the soil-boring log during drilling activities. The PID and CGI are calibrated at least once each day and more frequently if needed with the manufacturer specified calibration gas. The detailed procedures for the PID and CGI operation and calibration are included in the Generic EHS Plan (Volume II).

13.2 Perimeter Air Sampling

Perimeter air sampling may be required during field activities at the Site. Air sampling may be required during test pit excavation and/or during soil excavation/removal associated with an IRM. The basis for such sampling will be outlined in the Site-Specific Work Plan.

Prior to the collection of air samples, air-sampling stations, commonly one (1) upgradient and two (2) downgradient, will be set up at the Site perimeter. The location of these stations is based on daily wind direction during the field activities. A sample station would be setup so that the sample media (Summa canister, high volume sampler, whole air sampler or absorbent tube, etc.) would draw in air from approximately 2 to 4 feet above the ground surface. The sampling media would remain in place a maximum 24-hour period before it is shipped overnight to a laboratory for testing. Air samples are commonly analyzed for BTEX via Method TO-15 (summa canister using a whole air sampler) or TO-17 (using an absorbent tube) and PAHs via Method TO-13 (using a high volume sampler).

13.3 Building Interior Air Sampling for Volatile Organic Compounds (VOC)

When identified in the Site-Specific Work Plan, building air sampling will be performed in the on-site buildings during follow up investigations. Interior air sample collection will be performed in the basement and on the first floor of buildings potentially impacted by on-site contaminants. Various collection techniques will be used based on the type of contamination anticipated and the requirements set forth in the USEPA ERT SOP # 1704, #2121, and # 2119. Interior air sampling will also conform with NYSDOH indoor Air and Analysis guidance and the off-site Laboratory will have the New York State Environmental Laboratory Approval Program (ELAP) certification.

The following procedure will be used for air sampling of VOCs, based on USEPA ERT SOP

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#1704:

I. Subatmospheric Pressure Sampling Using a Fixed Orifice, Capillary, or Adjustable Micrometering Valve

- Complete the appropriate information on the Canister Sampling Data Field Sheet.
- A canister, which is evacuated to 0.05 mm Hg and fitted with a flow restricting device, is opened to the atmosphere which contains the VOCs for sampling. The pressure differential causes the sample to flow into the canister.
- This technique can be used to collect grab samples having a duration of 10 to 30 seconds or time-integrated samples having a duration of 12 to 24 hours. The sampling duration is depends on the degree to which the flow is restricted.
- As the pressure approaches atmospheric pressure, a critical orifice flow regulator will cause a decrease in the flow rate.
- Record data on an appropriate data sheet and/or in the field logbook.

The following procedure will be used for air sampling of VOCs, and is based on USEPA ERT SOP #1704:

ii. Subatmospheric Pressure Sampling or Pressurized Sampling Using a Mass Flow Controller/Vacuum Pump Arrangement (Andersen Sampler Model 87-100)

- Complete the appropriate information on the Canister Sampling Data Field Sheet.
- Open a canister, which is evacuated to 0.05 mm Hg and connected in line with the sampler, to the atmosphere, which contains the VOCs for sampling.
- A whole air sample will be drawn into the system through a stainless steel inlet tube by a direct drive blower motor assembly. A small portion of this whole air sample is drawn from the inlet tube by a specially modified inert vacuum pump in conjunction with a mass flow controller.
- The initially evacuated canister is filled by the action of the flow controlled pump to near atmospheric pressure (subatmospheric pressure sampling) or a positive pressure

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not to exceed 25 psig (pressurized sampling).

- A digital time program is used to pre-select sample duration and start and stop times.
- Record data on an appropriate data sheet and/or in the field logbook.

The following procedure will be used for air sampling of SVOCs and/or pesticides/PCBs, and is based on USEPA ERT SOP #2121:

- Using a calibrated sampler, place the sampler in the desired location. The polyurethane foam (PUF) sampler should be in the breathing zone in order to prevent elevated results. It should be located in an unobstructed area, at a distance of twice the height of any obstruction to air flow but no closer than two meters to the obstacle.
- Assemble the sampling system by attaching the legs and magnehelic panel to the platform. Connect the motor to the platform, making sure that the gasket is placed between the motor and the platform. Plug the motor into the timer located on the magnehelic panel. Connect the magnehelic to the venturi with tubing. Adjust the exhaust hose to face downwind of the sampler.
- Put on clean surgical gloves.
- Place the loaded sampling module into the quick release fitting and engage by locking the two levers down securely. Remove the metal cover.
- Record the pump number, location, sample start time, time/counter at the start, and other pertinent information on an appropriate data sheet and/or in the field logbook.
- Plug in the unit. If necessary, adjust the magnehelic gauge by turning the ball valve in order to achieve the reading required to reach the target flow rate. Wait approximately two minutes for the magnehelic reading to stabilize.
- Allow the sampling system to operate for the predetermined duration. If the sampling system is in use for more than 24 hours, the initial calibration should be audited every 24 hours. If the resultant value for the check is +/- 7 percent of the initial calibration, the sampling system must be recalibrated.

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The following procedure will be used for air sampling of metals, and is based on USEPA ERT SOP #2119:

- Assemble the sampling trains with clean filter cassettes. Verify the pump calibration by removing the inlet plug from the cassette, attaching a rotameter with Tygon tubing and turning on the sampling pump. Check to make sure all the connections are tight.
- Record the actual flow rate on an appropriate data sheet and/or in the field logbook. Replace the inlet plug until ready to sample.
- Set the sampling pump timer (low volume pumps) for the predetermined sampling time, or record the elapsed timer on the data sheet/logbook. This will be determined based on the type of pump being used.
- Deploy sampling pumps at sampling locations. Remove the cassette cap or inlet plug from the cassette. Sampling for elements can be conducted with the cassettes open-faced (cassette cap removed) or closed-faced (only inlet port plug removed). Open-faced is preferred because it allows even loading of the filter cassette and should be used whenever high particulate concentrations are expected in order to allow greater particulate loading of the filter. Closed-faced sampling is performed when there is a possibility that the sample may be shaken and particulates may be lost.
- Turn on the sampling pump and let it run for the predetermined sampling period.
- After the sampling period is over, verify the sampling period by reading the sample run time (low volume pumps) or by checking the elapsed time on the counter (medium volume pumps). Record the length of sampling time on the data sheet and/or in the field logbook. Turn off the pump.
- Verify the pump calibration by attaching a rotameter with Tygon tubing and turning on the sampling the inlet plug.
- Remove the sampling cassette from the sampling train and insert the outlet plug. Calculate sample volume.

14.0 GEOPHYSICAL AND SOIL GAS SURVEYS

When specified in the Site-Specific Work Plan, geophysical and soil gas surveys will be carried out at the site with the primary objective being to delineate areas of possible subsurface impacts from former MGP operations. Delineation of impacted areas will allow for a more focused and efficient sampling program during subsequent phases. Sampling locations may be located downgradient of potential historical MGP operations areas to determine if these areas act as contaminant sources. Also, boring locations can be adjusted to avoid large subsurface metallic bodies, thereby minimizing the potential for release of hazardous material from buried containers, and avoiding the expense associated with multiple boring attempts due to subsurface refusal. Furthermore, additional valuable subsurface information may be derived from this study, including:

- Delineation of underground structures(i.e. holder, and tar well);
- Mapping of existing site utilities and former MGP utilities; and,
- Detection of underground storage tanks (USTs) and/or other potential contaminant source areas.

If potential historical MGP operations areas prove to act as contaminant sources, the results of the geophysical investigation may also provide important information necessary for an Interim Removal action.

14.1 Geophysical Survey GPR and TDEMI

Two geophysical methods can be used for the geophysical survey: Time-domain Electromagnetic Induction (TDEMI) and ground penetrating radar (GPR). TDEMI can detect ferrous and non-ferrous metallic objects, such as a single 55-gallon drum, at a depth of up to 3 m (10 ft) bgs; GPR can detect both metallic and non-metallic subsurface targets at depths varying from several centimeters up to 20 m (65 ft bgs) or more, dependent upon frequency of induced waves, soil conductivity, and presence of extremely reflective interfaces. GPR can also be utilized to locate void spaces, detect disturbed soil or differential fill, and map Site Stratigraphy.

The TDEMI system utilized at the site will be the Geonics EM61 High Sensitivity Metal Detector or similar equipment. The EM61 is a one-person portable system designed primarily for industrial site assessment. The EM61 is relatively insensitive to nearby surface cultural interferences such as buildings, powerlines, and fences, and has the ability to record digital data at 0.17 second intervals, which translates to a spatial sample density of approximately 0.17 m (0.55 ft) along the ground surface.

The GPR system utilized at the site will be the Geophysical Survey Systems, Inc. (GSSI) SIR-2, or equivalent and will be equipped with both 200 and 500 MHZ antennas. The GSSI SIR-2 is a

monostatic GPR system, in which a single antenna is used as the transmitter and receiver. The antennas are shielded to ensure a high proportion of the energy produced is focused into the subsurface, decreasing noise from surrounding fences, buildings, and other features. The GPR reflection section is displayed in real time as data is acquired, and an analog record is output by an in-the-field printer. Data is also digitally logged to a high-capacity drive at a rate of 32 scans/second, which translates to a spatial sample density of approximately 0.03 m (0.1 ft) along the ground surface.

Geophysical Survey Ground Penetrating Radar (GPR) and Time-Domain Electromagnetic Induction (TDEMI)

The geophysical investigation will encompass all areas suspected of former MGP operations. The survey area will be run over both paved and vegetative cover and will be divided into four (4) subplots ranging in size from 0.2 to 0.5 acres. The EM61 data will be acquired using a Leica system 530 Global Positioning System (GPS), or equivalent equipment, for navigational control. GPS data will be captured in one second intervals, utilizing the real-time kinematic (RTK) mode, which provides centimeter-grade positional accuracy. GPR data will be acquired along a pre-established orthogonal grid system, with line and station spacing appropriate for detection of targets of interest.

Concurrent with geophysical data acquisition, cultural features maps will be developed which will detail the location of potential interferences such as buildings, fences, utilities, etc. These maps will be utilized in the interpretation stage to more accurately assess the significance of geophysical anomalies observed in the data.

TDEMI data will be processed and interpreted using manufacturer-supplied software. TDEMI data will be interpolated to accurate State Name Planar coordinates with appropriate shifts and filters applied, and data extrapolated to a regularly spaced grid system using accepted mathematical methods. These data will then be displayed as high-resolution color maps. Proprietary software will then be utilized to isolate and characterize subsurface anomalies potentially related to steel structures or buried drums.

GPR data will be processed and interpreted using WINRAD and/or GRADIX software packages or equivalent. Processing may include "rubber sheeting" of data to appropriate coordinates, application of appropriate gains and filters, display of color-coded GPR sections, and advanced processing techniques, such as migration and deconvolution. Diffraction hyperbolas or other discrete anomalies will be identified and characterized and compared with locations of EM61 anomalies. GPR anomalies, which occur in areas free of EM61 anomalies can be attributed to non-metallic targets, and may be associated with plastic barrels.

A final report including description of data collected, maps of the geophysical data, and interpretation of these data will be included in the Final Report.

Geophysical Survey Ground Penetrating Radar (GPR) and Time-Domain Electromagnetic Induction (TDEMI) Procedure

The geophysical survey will be conducted using the following procedure:

1. Clear the surface of the area to be surveyed (performed by clearing and grubbing subcontractor). This may include cutting underbrush to a height less than 0.3m (1 foot), removing trees less than 7.5 cm (3 inches) in diameter, removing brush, and mowing grasses greater than 0.6m (2 feet) in height. A sweep for metal objects on the ground surface will be conducted, and surficial metal identified will be noted and removed from the area of investigation.
2. Establish survey control within the investigation area. Survey markers will be installed both within and around the boundary of the survey area, and these points will be utilized to establish and calibrate the GPS base station.
3. Acquire data from each instrument from a test line prior to commencement of each day's activities. This test line will be performed over a known subsurface object or over a pre-placed object (such as a steel pipe).
4. Obtain GPS reading at a known survey point.
5. Begin survey at the southwest corner of the investigation area (or a subdivision of the investigation area) and progress northward (or eastward) until the area boundary or a major obstruction is encountered. TDEMI data will be acquired at a sampling rate of approximately 6 samples per second, which translates to a sample density of 1 sample every 0.17 meters (0.55 feet) based on an average walking pace. GPS data will be acquired concurrently with TDEMI data, at a rate of [1 sample] per second. GPR readings will be acquired at a sampling rate of approximately 32 scans per second, which translates to a sample density of 1 sample every 0.03 meters (0.1 feet) based on an average walking pace.
6. After reaching the grid boundary or obstruction, reverse direction, and acquire survey data in the opposite direction along a parallel line at the following line spacing: 1 meter (3 ft) for TDEMI readings and 2-meters (6 ft) for GPR readings.
7. Continue acquiring data in opposing directions, until the entire investigation area has been covered.
8. Acquire several lines of TDEMI data over a known linear metallic object placed upon the

ground surface. This procedure will allow for accurate time shifting of geophysical data necessary for merging the geophysical and GPS data.

9. Acquire data from the test line subsequent to each day's activities, for quality assurance comparison.
10. Obtain GPS reading at known survey point for QA comparison.

14.2 Geophysical Survey Magnetometer and FDEMI

A geophysical investigation to delineate areas of possible subsurface impacts can be performed by utilizing two geophysical methods: magnetometry and frequency-domain electromagnetic induction (FDEMI).

Geophysical data will be collected using two instruments: a Geometrics G-858G magnetometer (configured as a vertical gradiometer and including a continuous-recording base station) and a Geonics EM31-MK2 ground conductivity meter or equivalent equipment. Positional data will be verified by utilizing a Leica System 530 GPS system, or equivalent, for navigational control. GPS data will be captured at one second intervals, utilizing the real-time kinematic (RTK) mode, which provides centimeter-grad positional accuracy.

Geophysical Survey Magnetometry and Frequency-Domain Electromagnetic Induction (FDEMI) Procedure

The geophysical survey will be conducted using the following data collection procedure:

1. Clear the surface of the area to be surveyed (performed by clearing and grubbing subcontractor). This may include cutting underbrush to a height less than 1 foot, removing trees less than 3 inches in diameter, removing brush, and mowing grasses greater than 2 feet in height. A sweep for metal objects on the ground surface will be conducted, and surficial metal identified will be noted and removed from the area of investigation.
2. Establish survey control within the investigation area. Survey markers will be installed both within and around the boundary of the survey area, and these points will be utilized to establish positional control, as well as calibrate the GPS base station.
3. Acquire data from a test line prior to commencement of each day's activities. This test line will be performed over a known subsurface object or over a pre-placed object (such as a steel pipe).

4. Set up magnetometer base station.
5. Begin survey at the southwest corner of the investigation area (or a subdivision of the investigation area) and progress northward (or eastward) until the area boundary or a major obstruction is encountered. Magnetometry data will be acquired at a sampling rate of approximately 10 samples per second, which translates to a sample density of 1 sample every 0.1 meters (0.33 feet) based on an average walking pace. FDEMI conductivity readings will be acquired at a sampling rate of approximately 2.5 samples per second, which translates to a sample density of 1 sample every 0.4 meters (1.3 feet) based on an average walking pace. GPS data will be acquired concurrently with geophysical data, at a rate of 1 sample per second.
6. After reaching the boundary or obstruction, reverse direction, and acquire survey data in the opposite direction along a parallel line at the following line spacing: 1 meter for magnetometer readings and 2 meters for conductivity readings.
7. Continue acquiring data in opposing directions, until the entire investigation area has been covered.
8. Acquire several lines of geophysical data for a known linear metallic object placed upon the ground surface. This procedure will allow for accurate time shifting of geophysical data necessary for merging the geophysical and GPS data.
9. Repeatedly (at least 3 times per day) revisit a calibration station and collect data with the EM31, in order to provide for an instrument drift correction.
10. Acquire data from the test line subsequent to each day's activities, for quality assurance comparison.

The geophysical data will be processed and interpreted using manufacturer-supplied software. Data will be interpolated to NYS State Plane coordinates, filtered as appropriate, extrapolated to a grid system, and displayed on maps of the Site.

14.3 Downhole Geophysics

Downhole gamma-ray geophysical logging, if required in the Site Specific Work Plan, will be conducted by utilizing existing wells or soil borings as they are completed. Gamma-ray logging may be conducted in cased as well as uncased boreholes, and, because clays typically contain a higher

Generic FSP for Site Investigations at Manufactured Gas Plant Sites

percentage of gamma emitting minerals, can be useful for identification and correlation of clayey zones. The gamma-ray log can provide information on stratigraphic changes in the subsurface soils.

1. Be certain that the well has ample clearance for the gamma probe to pass without obstruction or binding. A dummy cylinder with the same diameter as the gamma log tool may be lowered downhole as a test for obstructions. Downhole may be performed if significant uncertainty exists. Wear appropriate health and safety equipment.
2. Set the tripod over the wellhead and park the mobile unit at a convenient location.
3. Slowly and carefully lower the probe to the bottom of the well with the logger recording the counts per second (cps) of gamma radiation. The descent is a "dry" run until the well bottom is attained.
4. Set the plotter so the gamma-ray logging is recorded on a graph. Set the upward speed at a constant rate. Bring the probe to the surface.
5. If the graph is successfully plotted, perform appropriate decontamination on the probe and the line and proceed to the next logging location.

14.4 Soil Gas Survey

A soil gas survey, if required by the Site-Specific Work Plan, will be performed around the Site to delineate areas of possible subsurface impacts and potential source areas. A sampling grid of approximately 100 feet by 100 feet or depending on the size of the investigation area, will be utilized across a majority of the Site, with soil gas samples collected at the grid nodes. Additional soil gas samples will be collected at 25 foot by 25 foot grid nodes in the vicinity of the potential test pit locations, and at any other additional areas determined during the field investigation (e.g., elevated levels present during real-time sampling, etc.). Actual sampling locations will be adjusted in the field to ensure sample targeting of all suspected areas of subsurface impacts. A field gas chromatograph (GC) will be used to determine sample screening concentrations of volatile organic compounds (VOCs). Water table, barometric, and temperature changes can vary the results.

The FOL or his designee, will be present on-site during active soil gas collection activities. The following soil gas survey activities will occur:

- Location of the soil gas survey locations;
- Comparison of the field GC data with applicable quality assurance data to determine acceptability of results;

Generic FSP for Site Investigations at Manufactured Gas Plant Sites

- Determination of the need for additional or a reduction in the number of soil gas survey points;
- Supervision of the topographic surveying to locate the sampling points;
- Review of the data analysis and evaluation from the soil gas survey report; and
- Recommendation for movement of the proposed field investigation sampling locations based on the soil gas survey results.

Soil Gas Survey Procedure

1. Record ambient air temperature and barometric pressure.
2. Drill a hole into the soil either by hand auger, rotary hammer, or driven rod (as conditions dictate), to roughly 4 to 5 feet in depth. The depth may be reduced based upon conditions at the Site at the time of sampling; all changes will be noted on Field Change Requests (see Section 13.0 of the QAPP).
3. Insert a probe, slightly smaller in diameter than the borehole, into the hole, and the hole will be sealed by packing soil around the expansion bulb at the probe top. The probe assembly will be selected by the soil gas crew and FOL, to provide the best probe assembly for the Site conditions. A typical assembly would consist of a 1/4-inch O.D. stainless steel probe, approximately 5-feet in length, and Teflon tubing, with a reducing tee and cap attached to the fitting.
4. Ensure/test vacuum with a gauge attached to the probe.
5. Extract soil gas through the probe via a vacuum pump connected to the tubing. Purge approximately 3 to 5 sample volumes prior to sampling to remove any introduced ambient contamination.
6. Remove the soil gas sample with a 500 uL gas-tight syringe or equivalent device, inserted into the tubing in front of the pump. This volume is adequate for achieving the required detection limit of 25 ug/L. If necessary, due to field conditions, the sample can be stored in a pressurized container.
7. Immediately inject the sample into the calibrated GC (see Step 8), and plot the chromatogram. Identify and quantify, based on standard peaks, any contaminants present in the soil gas

sample.

8. Calibrate the GC prior to sample analysis. Initial instrument calibration should consist of a minimum of 3 concentration points (5 points are preferred), to demonstrate the working range and linearity. Linearity will be assumed if the ratio of the area response to the amount injected is constant over the working range (i.e., less than 20 percent Relative Standard Deviation). In addition, an initial verification of a less than 25 ug/L detection limit shall be run.
9. Check the sample probe for contamination between each sample location, by drawing ambient air through the probe via the pump, and checking that the response is not greater than background levels. If necessary, decontaminate the probes using methanol and deionized water, and then air drying.

Calibration standards will be run at the beginning and end of each sampling day, and a method blank shall be analyzed every 12 hours and after any highly contaminated samples to check for carry-over. In addition, an environmental field duplicate will be chosen and analyzed every 20 samples.

15.0 FIELD INSTRUMENTS

All field analytical equipment will be calibrated immediately prior to each day's use and more frequently if required. A calibration log will be created on which all equipment calibration will be

recorded. Further details on calibration, precision, accuracy, etc. are provided in the Generic QAPP (Volume II). The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. If an equipment malfunction is identified during calibration then the malfunctioning equipment will be replaced or repaired within 24-hours or applicable fieldwork will be terminated as necessary until the malfunctioning equipment is repaired or replaced. Records of all instrument calibration will be maintained by the Field Operations Leader (FOL) and will be subject to audit by the Project Quality Assurance Manager (PQAM). Copies of all of the instrument manuals will be maintained on-site by the FOL.

15.1 Portable Photoionization Detector

The photoionization detector (PID) will be equipped with a minimum 10.6 eV lamp. The PID should be capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the volatile organic compounds on the NYSDEC ASP Target Compound List. Calibration will be performed at the beginning and end of each day of use with a standard calibration gas specified by the manufacturer. If the unit experiences abnormal perturbation or erratic readings, additional calibration will be required. All calibration data will be recorded in field logbooks and on calibration log sheets to be maintained on-site by the FOL.

A battery check will be completed at the beginning and end of each working day. If erratic readings are experienced, the battery will be checked for proper voltage. This information will also be recorded in field logbooks and on the calibration log sheets.

15.2 pH Meter

Calibration of the pH meter will be performed at the start of each day of use, and after very high or very low readings. National Institute of Standards and Technology - traceable standard buffer solutions, which bracket the expected pH range, will be used. The standards will most likely be pH of 7.0 and 10.0 standard units. The use of the pH calibration and slope knobs will be used to set the meter to display the value of the standard being checked. The pH meter readings during calibration must be within 0.1 of the reference solution. The calibration data will be recorded on calibration sheets maintained on-site by the FOL.

15.3 Specific Conductivity Meter

Calibration checks using the conductivity standard will be performed at the start of each day of use, after five to ten readings or after very high or low readings. The portable conductivity meter will be calibrated on a daily basis using a reference solution specified by the manufacturer. Readings must be within 5 percent to be acceptable. The thermometer of the meter will be calibrated against the field laboratory thermometer on a weekly basis.

15.4 Turbidity Meter

Calibration using a turbidity standard will be performed at the start of each day of use and after very high or low readings. The portable turbidity meter will be calibrated using a reference solution specified by the manufacturer. The turbidity reading must be within ± 2 NTU of the standard to be acceptable.

15.5 DO Meter

Calibration using a DO standard will be performed at the start of each day of use. The portable DO meter will be calibrated using a calibration solution specified by the manufacturer. The DO reading must be within 5% of the standard to be acceptable.

15.6 Combustible Gas Indicator

Calibration of the CGI will conform to the procedures prescribed in the Generic Environmental Health and Safety Plan (Volume II). Calibration will occur at the start of each day of use.

16.0 MANAGEMENT OF INVESTIGATION DERIVED WASTE

During the implementation of field activities, investigation derived wastes (IDW) will be generated at the Site. These IDWs will include the following: soil drilling mud/water, development and purge water, decontamination wash water, PPE, polysheeting, spent decontamination fluids, etc. Following the generation of these IDWs, they will be properly containerized in 55-gallon drums, frac tanks, agricultural poly tanks, and/or roll-off containers. PPE will be bagged and placed in 55-gallon drums. The containers will be properly labeled with the date of generation, the Site name, client name and address, contents of the containers, etc. Upon generation the IDW will be immediately containerized. The containers will be secured at the end of each day at the Site. The containers will be segregated on-site in a temporary fenced area and signs stating "Do Not Enter" will be posted on the fencing. Upon completion of the field activities, the containers will be sampled for disposal characteristics. IDW materials will be removed from the Site and shipped to an approved facility. Waste handling procedures and regulations will be strictly adhered to during all phases of waste handling.

17.0 REFERENCES:

Atlas of Community Water System Sources

Bouwer and Rice, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, *Water Resources Research*, v. 12, pp. 423-428.

Cooper, Bredehoeft, and Papadopoulos, 1967: Response of a Finite Diameter Well to an Instantaneous Charge of Water. *Water Resources Research*, vol. 3, no. 1, pp. 263-269.

Haling and Weaver, 1991: Dense Nonaqueous Phase Liquids, *EPA Groundwater Issue*. March, 1991.

Leupold & Stevens, Inc. 1978: *Stevens Water Resources Data Book*, 3rd Edition.

USEPA, 1998: Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures. 540/5-95/504.

TABLES

LLL [*]	LL [*]	NN [*]	NN/NNNN [*]
Site	Sample Type	Sample Location	Depth/Time

Sample Type:

Monitoring Well (MW), Surface Soil (SS),
Subsurface Soil (SB), Sediment (SD),
Surface Water (SW), Waste Water (WW), Solid Waste (WA)

Number referenced to a sample location map illustrated in the Site-Specific

* L = Letter
* N = Number

FIGURES

Figure 1

						LOG OF BORING			
						(Page 1 of 1)			
PROJECT: PROJECT NO.: LOCATION:				DATE STARTED: : DATE COMPLETED: : GEOLOGIST: : DRILLER: : DRILLING METHOD: :		GW DEPTH: : ELEVATION: :			
Depth in feet	RECOVERY	USCS	GRAPHIC	DESCRIPTION	TIME	DATE	PID (ppm)	Sample I.D.	COMMENTS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
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25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

LOG OF BORING

(Page 1 of 1)

PROJECT:
PROJECT NO.:
LOCATION:

DATE STARTED: :
DATE COMPLETED: :
GEOLOGIST: :
DRILLER: :
DRILLING METHOD: :

GW DEPTH: :
ELEVATION: :

Depth in feet	RECOVERY	USCS	GRAPHIC	DESCRIPTION	TIME	DATE	PID (ppm)	Sample I.D.	COMMENTS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
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34									
35									
36									

Notes:

FOSTER  WHEELER

Figure 2

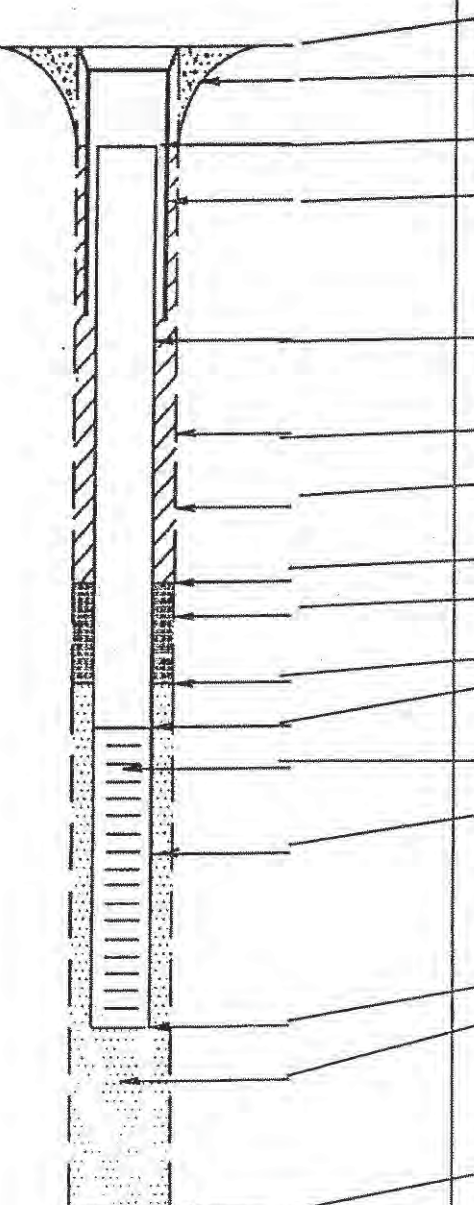
UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO. _____

PROJECT _____
PROJECT NO. _____
DATE _____ BORING NO.: _____
ELEVATION _____
LOGGED BY: _____

DRILLER _____
DRILLING _____
METHOD _____
DEVELOPMENT _____
METHOD _____

GROUND
SURFACE



ELEVATION OF TOP OF SURFACE CASING: _____
TYPE OF SURFACE SEAL: _____
GROUND SURFACE ELEVATION: _____
ELEVATION OF TOP OF RISER: _____

I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____

RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____

BOREHOLE DIAMETER: _____

TYPE OF BACKFILL: _____

ELEVATION/DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____

ELEVATION/DEPTH TOP OF SAND PACK: _____
ELEVATION/DEPTH TOP OF SCREEN: _____

TYPE OF SCREEN: _____
SLOT SIZE X LENGTH: _____
TYPE OF SAND PACK: _____

ELEVATION/DEPTH BOTTOM OF SCREEN: _____

ELEVATION/DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____

ELEVATION/DEPTH OF HOLE: _____

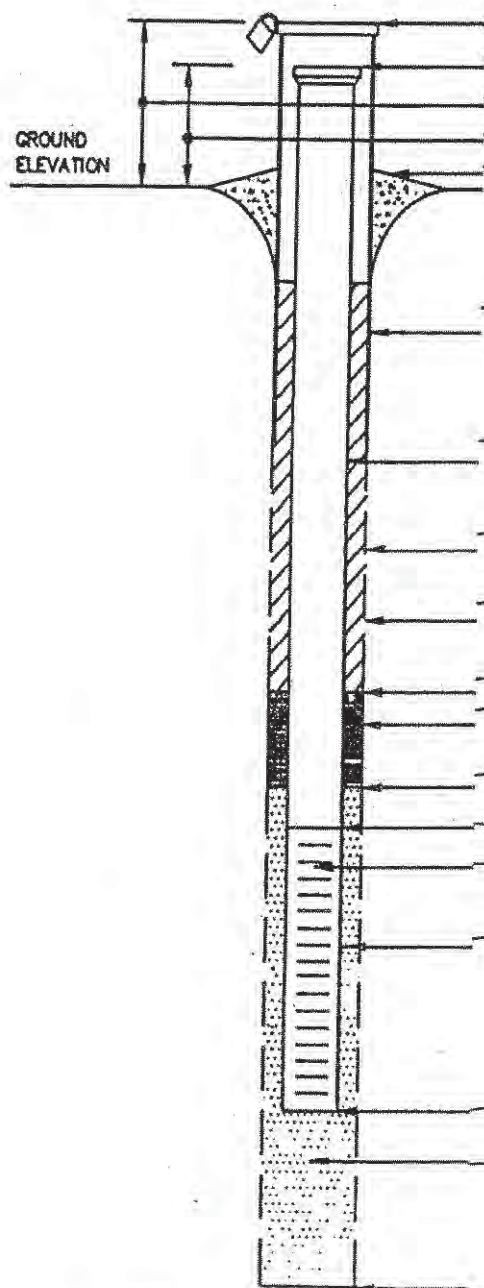
Figure 3

OVERBURDEN
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. _____

PROJECT _____
PROJECT NO. _____
DATE _____ BORING NO.: _____
ELEVATION _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING _____
METHOD _____
DEVELOPMENT _____
METHOD _____



ELEVATION OF TOP OF SURFACE CASING: _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK-UP TOP OF SURFACE CASING: _____
STICK-UP RISER PIPE: _____
TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____

RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____

BOREHOLE DIAMETER: _____

TYPE OF BACKFILL: _____

ELEVATION/DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____

DEPTH TOP OF SAND PACK: _____

ELEVATION/DEPTH TOP OF SCREEN: _____
TYPE OF SCREEN: _____
SLOT SIZE X LENGTH: _____
TYPE OF SAND PACK: _____

ELEVATION/DEPTH BOTTOM OF SCREEN: _____
ELEVATION/DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____

ELEVATION/DEPTH OF HOLE: _____

NOT TO SCALE

NOT TO SCALE

DOUBLE CASED MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO. _____

PROJECT _____
 PROJECT NO. _____
 DATE _____ BORING NO.: _____
 ELEVATION _____
 FIELD GEOLOGIST _____

DRILLER _____
 DRILLING _____
 METHOD _____
 DEVELOPMENT _____
 METHOD _____

GROUND ELEVATION _____

ELEVATION OF TOP OF CASING: _____
 STICK-UP OF CASING ABOVE GROUND SURFACE _____

ELEVATION OF TOP OF RISER PIPE _____
 STICK-UP RISER PIPE _____

I.D. OF SURFACE CASING: _____
 TYPE OF SURFACE CASING: _____
 TYPE OF SURFACE SEAL: _____

TYPE OF BACKFILL: _____
 I.D. OF UPPER AQUIFER CASING: _____
 TYPE OF UPPER AQUIFER CASING: _____

BOREHOLE DIAMETER/DEPTH: _____

I.D. OF RISER: _____
 TYPE OF RISER: _____

DEPTH CASING IS SET IN CONFINING LAYER: _____

APPROXIMATE THICKNESS OF CONFINING LAYER: _____

ELEVATION/DEPTH TOP OF SEAL: _____
 TYPE OF SEAL: _____

DEPTH TOP OF SAND PACK: _____
 TYPE OF SAND PACK: _____

BOREHOLE DIAMETER: _____

TYPE OF SCREEN: _____
 SLOT SIZE X LENGTH: _____
 I.D. OF SCREEN: _____

ELEVATION/DEPTH BOTTOM OF SCREEN: _____
 ELEVATION/DEPTH BOTTOM OF SAND PACK: _____
 TYPE OF BACKFILL BELOW OBSERVATION WELL: _____
 ELEVATION/DEPTH OF HOLE: _____

Figure 5

WELL PURGE DATA SHEET

PROJECT NAME: _____

PROJECT No.: _____

DATE: _____

Well I.D.: _____

Casing Volume

Well Diameter (d) = _____ ft

Well Radius (r_w) = _____ ft

Well Depth (TD) = _____ ft

Static Water Level (WL) = _____ ft

Filter Pack VolumeBorehole Diameter (d_b) = _____ ftBorehole Radius (r_b) = _____ ftDepth to Top of Filter Pack (D_f) = _____ ft

P = estimated porosity of filter pack

Height of Water in Well (T): $T = TD \text{ (ft)} - WL \text{ (ft)}$

T = _____ - _____

T = _____ ft

Height of Water in Filter Pack (T_F) $T_F = TD - WL^1 \text{ (or TFP}^2\text{)}$ $T_F = \text{_____} - \text{_____}$ $T_F = \text{_____} \text{ ft}$ **Gallons of Water per Well Volume (Casing):** $V_C = 0.163 \times T \text{ (ft)} \times r_w \text{ (in)}^2$ $V_C = 0.163 \times \text{_____} \times \text{_____}^2$ $V_C = \text{_____} \text{ gallons}$ **Gallons of Water per Filter Pack Volume** $V_F = (0.163 \times r_b^2 - 0.163 \times r_w^2) \times T_F \times P$

$$V_T = V_C + V_F$$

Total Volume Purged: Design = _____ gallons

Actual = _____ gallons

Water Quality:

	pH (SU)	Spec. Conduct (umhos/cm)	Temp. (°C)	Eh (mV)	D.O. (ml/L)
Initial	_____	_____	_____	_____	_____
Volume 1	_____	_____	_____	_____	_____
Volume 2	_____	_____	_____	_____	_____
Volume 3	_____	_____	_____	_____	_____
Volume 4	_____	_____	_____	_____	_____
Volume 5	_____	_____	_____	_____	_____

Purge Method: _____ Suction Pump _____ Submersible Pump _____ Bailer _____ Other _____

Notes/Observations: _____

FWENC-Sampler(s) Present: _____

1. From Top of Inner Casing
2. Top of Filter Pack - used if entire filter pack saturated

SAMPLE LOG SHEET

Project: _____ Project No.: _____
 Client: _____ Project Manager: _____
 Sample Name/Number: _____ Date: _____ Time: _____ Hrs
 Sampling Location/Depth: _____ Type: _____ Grab _____ Composite
 Sample Matrix: _____ Surface Water _____ Groundwater _____ Sediment
 _____ Soil _____ Waste
 _____ Other (Specify) _____

Sampled By: _____

☐ Well	☐ Outfall	☐ Leachate
☐ Drum	☐ Boring	☐ River/Stream
☐ Bldg/Structures	☐ Tank	☐ Impoundment
☐ Test Pit/Trench	☐ Other (Specify)	

Source Description _____

Appearance/Color: _____

Volatile Organic Analysis (VOA): _____ HNU _____ OVA _____ Other _____

VOA Readings: Off Sample _____ Respiratory Zone _____

LEL/O₂/H₂S Readings: LEL _____ O₂ _____ H₂S _____

Radioactivity (mR/hr): _____

pH: _____ Conductivity: _____ Temperature: _____

Salinity: _____ Other: _____

Observations: _____

Preservation: _____
 Laboratory Name: _____
 Laboratory Location: _____ On-Site _____ Off-Site _____
 Forwarded to Laboratory: _____ Date: _____ Time: _____ Hrs
 Laboratory Sample No.: _____
 Chain of Custody No.: _____ Airbill No.: _____

V. ADDITIONAL REMARKS

ATTACHMENTS

ATTACHMENT A

GROUNDWATER ISSUE – DENSE NONAQUEOUS PHASE LIQUIDS



Ground Water Issue

DENSE NONAQUEOUS PHASE LIQUIDS

Scott G. Huling* and James W. Weaver**

Background

The Regional Superfund Ground Water Forum is a group of EPA professionals representing EPA's Regional Superfund Offices, committed to the identification and the resolution of ground water issues impacting the remediation of Superfund sites. The forum is supported by and advises the Superfund Technical Support Project. Dense nonaqueous phase liquids is an issue identified by the Forum as a concern of Superfund decision-makers. For further information contact Scott G. Huling (FTS:743-2313), Jim Weaver (FTS:743-2420), or Randall R. Ross (FTS: 743-2355).

Introduction

Dense nonaqueous phase liquids (DNAPLs) are present at numerous hazardous waste sites and are suspected to exist at many more. Due to the numerous variables influencing DNAPL transport and fate in the subsurface, and consequently, the increasing complexity, DNAPLs are largely undetected and yet are likely to be a significant limiting factor in site remediation. This issue paper is a literature evaluation focusing on DNAPLs and provides an overview from a conceptual fate and transport point of view, DNAPL phase distribution, monitoring, site characterization, remediation, and modeling.

A nonaqueous phase liquid (NAPL) is a term used to describe the physical and chemical differences between a hydrocarbon liquid and water which result in a physical interface between a mixture of the two liquids. The interface is a physical dividing surface between the bulk phases of the two liquids, but compounds found in the NAPL are not prevented from solubilizing into the ground water. Immiscibility is typically determined based on the visual observation of a physical interface in a water-hydrocarbon mixture. There are numerous methods, however, which are used to quantify the physical and chemical properties of hydrocarbon liquids (31).

Nonaqueous phase liquids have typically been divided into two general categories, dense and light. These terms describe the specific gravity, or the weight of the nonaqueous phase liquid relative to water. Correspondingly, the dense nonaqueous

phase liquids have a specific gravity greater than water, and the light nonaqueous phase liquids (LNAPL) have a specific gravity less than water.

Several of the most common compounds associated with DNAPLs found at Superfund sites are included in Table 1. These compounds are a partial list of a larger list identified by a national screening of the most prevalent compounds found at Superfund sites (65). The general chemical categories are halogenated/non-halogenated semi-volatiles and halogenated volatiles. These compounds are typically found in the following wastes and waste-producing processes: solvents, wood preserving wastes (creosote, pentachlorophenol), coal tars, and pesticides. The most frequently cited group of these contaminants to date are the chlorinated solvents.

DNAPL Transport and Fate - Conceptual Approach

Fate and transport of DNAPLs in the subsurface will be presented from a conceptual point of view. Figures have been selected for various spill scenarios which illustrate the general behavior of DNAPL in the subsurface. Following the conceptual approach, detailed information will be presented explaining the specific mechanisms, processes, and variables which influence DNAPL fate and transport. This includes DNAPL characteristics, subsurface media characteristics, and saturation dependent parameters.

Unsaturated Zone

Figure 1 indicates the general scenario of a release of DNAPL into the soil which subsequently migrates vertically under both the forces of gravity and soil capillarity. Soil capillarity is also responsible for the lateral migration of DNAPL. A point is reached at which the DNAPL no longer holds together as a continuous phase, but rather is present as isolated residual globules. The fraction of the hydrocarbon that is retained by capillary forces in the porous media is referred to as residual

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Superfund Technology Support Center for
Ground Water

Robert S. Kerr Environmental
Research Laboratory
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Technology Innovation Office
Office of Solid Waste and Emergency
Response, US EPA, Washington, D.C.

Walter W. Kovalick, Jr., Ph.D.
Director

Table 1. Most prevalent chemical compounds at U.S. Superfund Sites (65) with a specific gravity greater than one.

Compound	Density [1]	Dynamic[2] Viscosity	Kinematic Viscosity[3]	Water[4] Solub.	Henry's Law Constant[5]	Vapor[6] Pressure
Halogenated Semi-volatiles						
1,4-Dichlorobenzene	1.2475	1.2580	1.008	8.0 E+01	1.58 E-03	6 E-01
1,2-Dichlorobenzene	1.3060	1.3020	0.997	1.0 E+02	1.88 E-03	9.6 E-01
Aroclor 1242	1.3850			4.5 E-01	3.4 E-04	4.06 E-04
Aroclor 1260	1.4400			2.7 E-03	3.4 E-04	4.05 E-05
Aroclor 1254	1.5380			1.2 E-02	2.8 E-04	7.71 E-05
Chlordane	1.6	1.1040	0.69	5.6 E-02	2.2 E-04	1 E-05
Dieldrin	1.7500			1.86 E-01	9.7 E-06	1.78 E-07
2,3,4,6-Tetrachlorophenol	1.8390			1.0 E+03		
Pentachlorophenol	1.9780			1.4 E+01	2.8 E-06	1.1 E-04
Halogenated Volatiles						
Chlorobenzene	1.1060	0.7560	0.683	4.9 E+02	3.46 E-03	8.8 E+00
1,2-Dichloropropane	1.1580	0.8400	0.72	2.7 E+03	3.6 E-03	3.95 E+01
1,1-Dichloroethane	1.1750	0.3770	0.321	5.5 E+03	5.45 E-04	1.82 E+02
1,1-Dichloroethylene	1.2140	0.3300	0.27	4.0 E+02	1.49 E-03	5 E+02
1,2-Dichloroethane	1.2530	0.8400	0.67	8.69 E+03	1.1 E-03	6.37 E+01
Trans-1,2-Dichloroethylene	1.2570	0.4040	0.321	6.3 E+03	5.32 E-03	2.65 E+02
Cis-1,2-Dichloroethylene	1.2480	0.4670	0.364	3.5 E+03	7.5 E-03	2 E+02
1,1,1-Trichloroethane	1.3250	0.8580	0.647	9.5 E+02	4.08 E-03	1 E+02
Methylene Chloride	1.3250	0.4300	0.324	1.32 E+04	2.57 E-03	3.5 E+02
1,1,2-Trichloroethane	1.4436	0.1190	0.824	4.5 E+03	1.17 E-03	1.88 E+01
Trichloroethylene	1.4620	0.5700	0.390	1.0 E+03	8.92 E-03	5.87 E+01
Chloroform	1.4850	0.5630	0.379	8.22 E+03	3.75 E-03	1.6 E+02
Carbon Tetrachloride	1.5947	0.9650	0.605	8.0 E+02	2.0 E-02	9.13 E+01
1,1,2,2-Tetrachloroethane	1.6	1.7700	1.10	2.9 E+03	5.0 E-04	4.9 E+00
Tetrachloroethylene	1.6250	0.8900	0.54	1.5 E+02	2.27 E-02	1.4 E+01
Ethylene Dibromide	2.1720	1.6760	0.79	3.4 E+03	3.18 E-04	1.1 E+01
Non-halogenated Semi-volatiles						
2-Methyl Naphthalene	1.0058			2.54 E+01	5.06 E-02	6.80 E-02
o-Cresol	1.0273			3.1 E+04	4.7 E-05	2.45 E-01
p-Cresol	1.0347			2.4 E+04	3.5 E-04	1.08 E-01
2,4-Dimethylphenol	1.0360			6.2 E+03	2.5 E-06	9.8 E-02
m-Cresol	1.0380	21.0	20	2.35 E+04	3.8 E-05	1.53 E-01
Phenol	1.0576		3.87	8.4 E+04	7.8 E-07	5.293 E-01
Naphthalene	1.1620			3.1 E+01	1.27 E-03	2.336 E-01
Benzo(a)Anthracene	1.1740			1.4 E-02	4.5 E-06	1.16 E-09
Flourene	1.2030			1.9 E+00	7.65 E-05	6.67 E-04
Acenaphthene	1.2250			3.88 E+00	1.2 E-03	2.31 E-02
Anthracene	1.2500			7.5 E-02	3.38 E-05	1.08 E-05
Dibenz(a,h)Anthracene	1.2520			2.5 E-03	7.33 E-08	1 E-10
Fluoranthene	1.2520			2.65 E-01	6.5 E-06	E-02 E-06
Pyrene	1.2710			1.48 E-01	1.2 E-05	6.67 E-06
Chrysene	1.2740			6.0 E-03	1.05 E-06	6.3 E-09
2,4-Dinitrophenol	1.6800			6.0 E+03	6.45 E-10	1.49 E-05
Miscellaneous						
Coal Tar	1.028 ^m	18.98 ^m				
Creosote	1.05	1.08 ^m				

[1] g/cc

[2] centipoise (cp), water has a dynamic viscosity of 1 cp at 20°C.

[3] centistokes (cs)

[4] mg/l

[5] atm-m³/mol

[6] mm Hg

[7] 45° F (70)

[8] 15.5°C, varies with creosote mix (62)

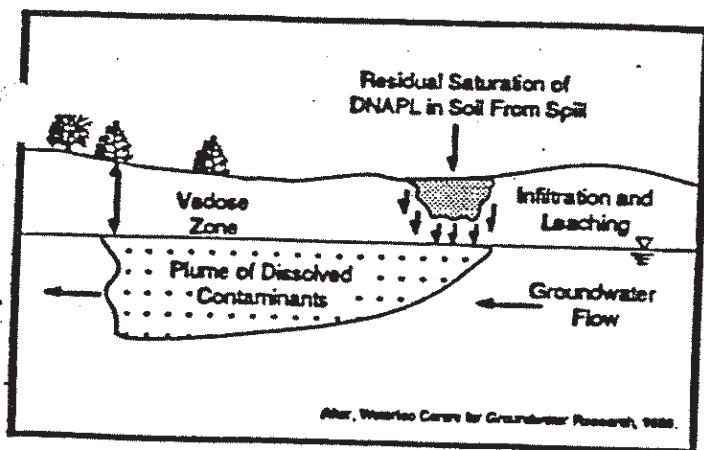


Figure 1. The entire volume of DNAPL is exhausted by residual saturation in the vadose zone prior to DNAPL reaching the water table. Soluble phase compounds may be leached from the DNAPL residual saturation and contaminate the ground water.

saturation. In this spill scenario, the residual saturation in the unsaturated zone exhausted the volume of DNAPL, preventing it from reaching the water table. This figure also shows the subsequent leaching (solubilization) of the DNAPL residual saturation by water percolating through the unsaturated zone (vadose zone). The leachate reaching the saturated zone results in ground-water contamination by the soluble phase components of the hydrocarbon. Additionally, the residual saturation at or near the water table is also subjected to leaching from the rise and fall of the water table (seasonal, sea level, etc.).

Increasing information is drawing attention to the importance of the possibility that gaseous-phase vapors from NAPL in the unsaturated zone are responsible for contaminating the ground water and soil (18,47). It is reported that the greater "relative vapor density" of gaseous vapors to air will be affected by gravity and will tend to sink. In subsurface systems where lateral spreading is not restricted, spreading of the vapors may occur as indicated in Figure 2. The result is that a greater amount of soils and ground water will be exposed to the DNAPL vapors and may result in further contamination. The extent of contamination will depend largely on the partitioning of the DNAPL vapor phase to the aqueous and solid phases.

DNAPL Phase Distribution - Four Phase System

It is apparent from Figures 1 and 2 that the DNAPL may be present in the subsurface in various physical states or what is referred to as phases. As illustrated in Figure 3, there are four possible phases: gaseous, solid, water, and immiscible hydrocarbon (DNAPL) in the unsaturated zone. Contaminants associated with the release of DNAPL can, therefore, occur in four phases described as follows:

1. Air phase - contaminants may be present as vapors;
2. Solid phase - contaminants may adsorb or partition onto the soil or aquifer material;
3. Water phase - contaminants may dissolve into the water according to their solubility; and

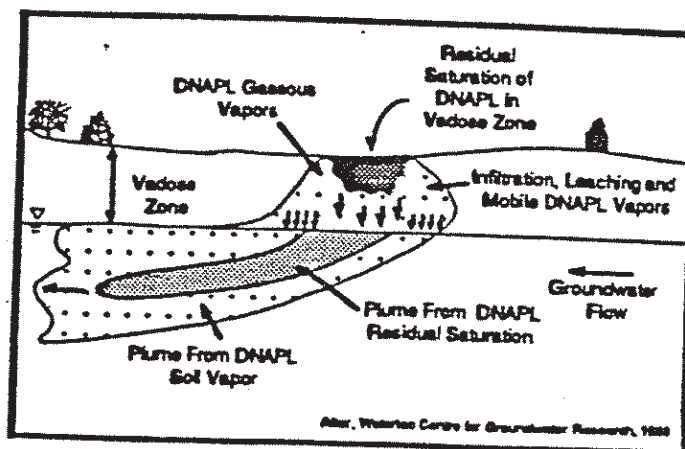


Figure 2. Migration of DNAPL vapors from the spill area and subsequent contamination of the soils and ground water.

4. Immiscible phase - contaminants may be present as dense nonaqueous phase liquids.

The four phase system is the most complex scenario because there are four phases and the contaminant can partition between any one or all four of these phases, as illustrated in Figure 4. For example, TCE introduced into the subsurface as a DNAPL may partition onto the soil phase, volatilize into the soil gas, and solubilize into the water phase resulting in contamination in all four phases. TCE can also partition between the water and soil, water and air, and between the soil and air. There are six pathways of phase distribution in the unsaturated zone. The distribution of a contaminant between these phases can be represented by empirical relationships referred to as partition coefficients. The partition coefficients, or the distribution of the DNAPL between the four phases, is highly site-specific and highly dependent on the characteristics of both the soil/aquifer matrix and the DNAPL. Therefore, the distribution between phases may change with time and/or location at the same site and during different stages of site remediation.

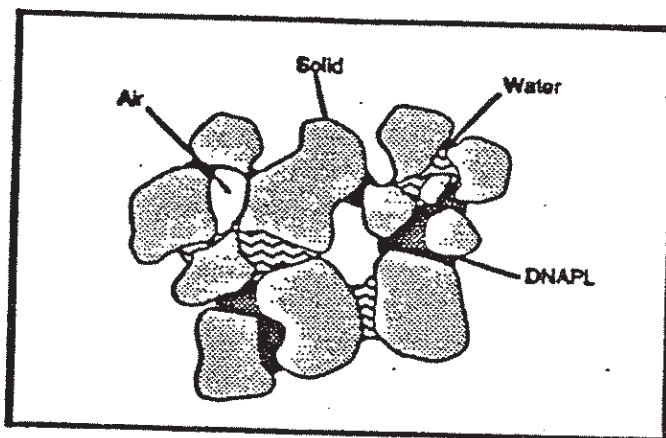
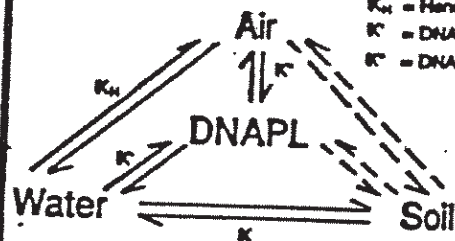


Figure 3. A DNAPL contaminated unsaturated zone has four physical states or phases (air, solid, water, immiscible). The contaminant may be present in any one, or all four phases.

Four Phase System

Partition Coefficients

- K = Soil-water partition coefficient
- K_H = Henry's Constant
- K' = DNAPL-water partition coefficient
- K'' = DNAPL-air partition coefficient



after D.C. Clark, 1980 (9)

Figure 4. Distribution of DNAPL between the four phases found in the vadose zone.

The concept of phase distribution is critical in decision-making. Understanding the phase distribution of a DNAPL introduced into the subsurface provides significant insight in determining which tools are viable options with respect to site characterization and remediation.

DNAPL represented by residual saturation in the four phase diagram is largely immobile under the usual subsurface pressure conditions and can migrate further only: 1) in water according to its solubility; or 2) in the gas phase of the unsaturated zone (47). DNAPL components adsorbed onto the soil are also considered immobile. The mobile phases are, therefore, the soluble and volatile components of the DNAPL in the water and air, respectively.

The pore space in the unsaturated zone may be filled with one or all three fluid phases (gaseous, aqueous, immiscible). The presence of DNAPL as a continuous immiscible phase has the potential to be mobile. The mobility of DNAPL in the subsurface must be evaluated on a case by case basis. The maximum number of potentially mobile fluid phases is three. Simultaneous flow of the three phases (air, water, and immiscible) is considerably more complicated than two-phase flow (46). The mobility of three phase flow in a four-phase system is complex, poorly understood, and is beyond the scope of this DNAPL overview. The relative mobility of the two phases, water and DNAPL, in a three-phase system is presented below in the section entitled "Relative Permeability."

Generally, rock aquifers contain a myriad of cracks (fractures) of various lengths, widths, and apertures (32). Fractured rock systems have been described as rock blocks bounded by discrete discontinuities comprised of fractures, joints, and shear zones which may be open, mineral-filled, deformed, or any combination thereof (61). The unsaturated zone overlying these fractured rock systems also contain the myriad of preferential pathways. DNAPL introduced into such formations (Figure 5) follow complex pathways due to the heterogeneous distribution of the cracks, conduits, and fractures, i.e., preferential pathways. Transport of DNAPL may follow non-Darcian flow in the open fractures and/or Darcian flow in the porous media filled fractures. Relatively small volumes of DNAPL may move deep, quickly into the rock because the

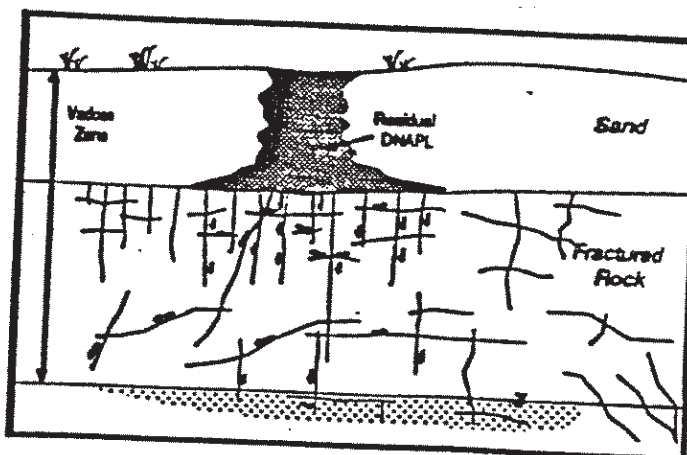


Figure 5. DNAPL spilled into fractured rock systems may follow a complex distribution of the preferential pathways.

retention capacity offered by the dead-end fractures and the immobile fragments and globules in the larger fractures is so small (32). Currently, the capability to collect the detailed information for a complete description of a contaminated fractured rock system is regarded as neither technically possible nor economically feasible (61).

Low permeability stratigraphic units such as high clay content formations may also contain a heterogeneous distribution of preferential pathways. As illustrated in Figure 6, DNAPL transport in these preferential pathways is correspondingly complex. Typically, it is assumed that high clay content formations are impervious to DNAPL. However, as DNAPL spreads out on low permeable formations it tends to seek out zones of higher permeability. As a result, preferential pathways allow the DNAPL to migrate further into the low permeable formation, or through it to underlying stratigraphic units. It is apparent from Figures 5 and 6 that the complexity of DNAPL transport may be significant prior to reaching the water table.

Saturated Zone

The second general scenario is one in which the volume of DNAPL is sufficient to overcome the fraction depleted by the residual saturation in the vadose zone, as illustrated in Figure 7. Consequently, the DNAPL reaches the water table and contaminates the ground water directly. The specific gravity of DNAPL is greater than water, therefore, the DNAPL migrates into the saturated zone. In this scenario, DNAPL continues the vertical migration through the saturated zone until the volume is eventually exhausted by the residual saturation process or until it is intercepted by a low permeable formation where it begins to migrate laterally.

DNAPL Phase Distribution - Three Phase System

Due to the lack of the gaseous phase, the saturated zone containing DNAPL is considered a three-phase system consisting of the solid, water, and immiscible hydrocarbon (Figure 8). Contaminant distribution in the three-phase system is less complex than the four-phase system. Again, this is highly dependent on the characteristics of both the aquifer

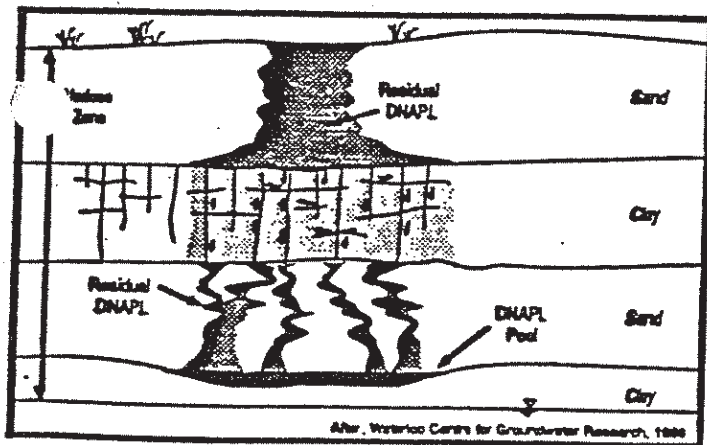


Figure 6. DNAPL spilled into a low permeable formation may follow a complex distribution of preferential pathways. The volume of DNAPL is exhausted in the vadose zone prior to reaching the water table.

matrix and the DNAPL. Figure 9 indicates the three phases and the transfer of the mass of contaminant between the phases. In this scenario, there are only three pathways of phase distribution in the saturated zone.

Note that when the DNAPL is represented by residual saturation in the three-phase system, the mobile phase of the contaminant is the water soluble components of the DNAPL and the immobile phases are the residual saturation and the adsorbed components of the DNAPL associated with the soil material. The main mobilization mechanism of the residual saturation is removal of soluble phase components into the ground water. When the DNAPL is present as a continuous immiscible phase, it too is considered one of the mobile phases of the contaminant. While the continuous phase DNAPL has the potential to be mobile, immobile continuous phase DNAPL may also exist in the subsurface. Although the saturated zone is considered a three-phase system, gaseous vapors from DNAPL in the unsaturated zone does have the

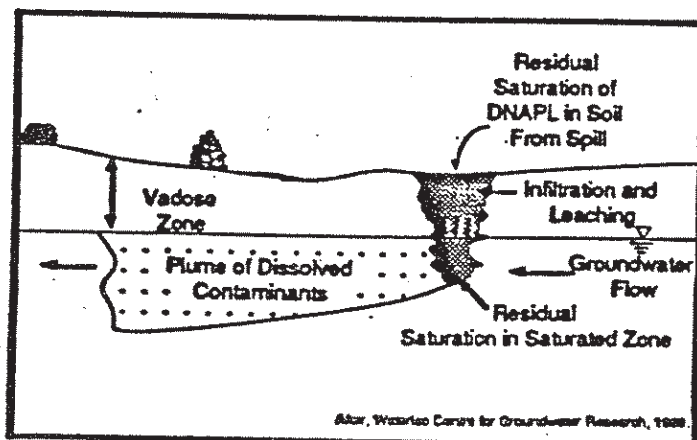


Figure 7. The volume of DNAPL is sufficient to overcome the residual saturation in the vadose zone and consequently penetrates the water table.

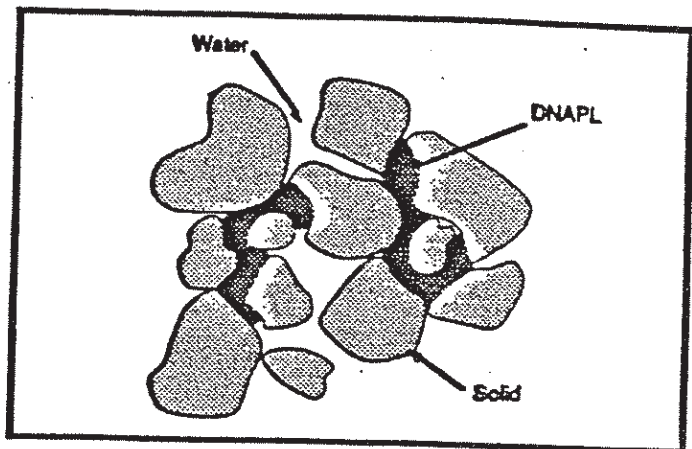


Figure 8. A DNAPL contaminated saturated zone has three phases (solid, water, immiscible). The contaminant may be present in any one, or all three phases.

potential to affect ground-water quality, as was indicated earlier in Figure 2.

Assuming the residual saturation in the saturated zone does not deplete the entire volume of the DNAPL, the DNAPL will continue migrating vertically until it encounters a zone or stratigraphic unit of lower permeability. Upon reaching the zone of lower permeability, the DNAPL will begin to migrate laterally. The hydraulic conductivity in the vertical direction is typically less than in the horizontal direction. It is not uncommon to find vertical conductivity that is one-fifth or one-tenth the horizontal value (4). It is expected that DNAPL spilled into the subsurface will have a significant potential to migrate laterally. If the lower permeable boundary is "bowl shaped", the DNAPL will pond as a reservoir (refer to Figure 10). As illustrated in Figure 11, it is not uncommon to observe a perched DNAPL reservoir where a discontinuous impermeable layer; i.e., silt or clay lens, intercepts the vertical migration of DNAPL. When a sufficient volume of DNAPL has been released and multiple discontinuous impermeable layers exist, the DNAPL may be present in several perched reservoirs as well as a deep

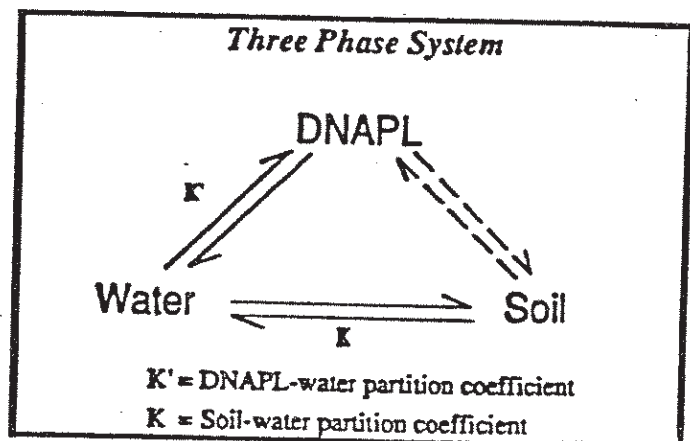


Figure 9. Distribution of DNAPL between the three phases found in the saturated zone.

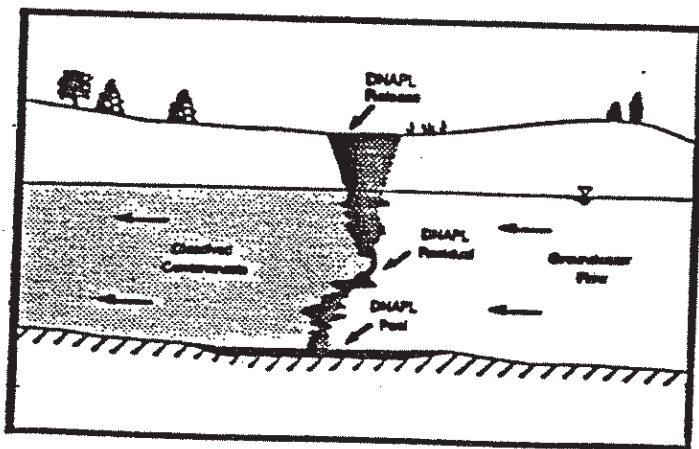


Figure 10. Migration of DNAPL through the vadose zone to an impermeable boundary.

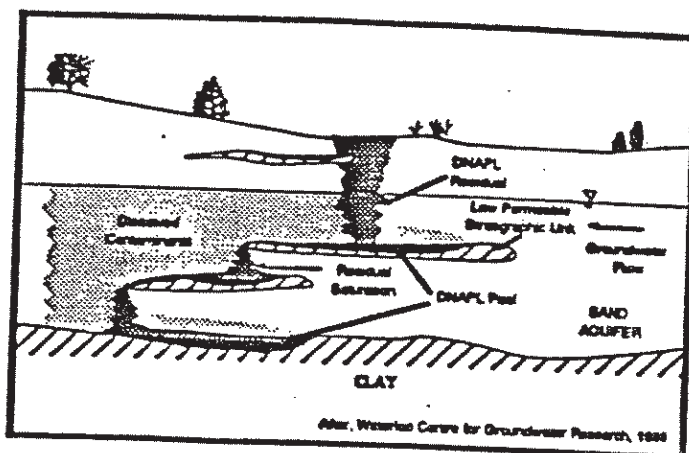


Figure 12. Perched and deep DNAPL reservoirs.

reservoir (refer to Figure 12). Lateral migration continues until either the residual saturation depletes the DNAPL or an impermeable depression immobilizes the DNAPL in a reservoir type scenario. Soluble-phase components of the DNAPL will partition into the ground water from both the residual saturation or DNAPL pools. The migration of DNAPL vertically through the aquifer results in the release of soluble-phase components of the DNAPL across the entire thickness of the aquifer. Note, that ground water becomes contaminated as it flows through, and around, the DNAPL contaminated zone.

As indicated earlier, DNAPL will migrate laterally upon reaching a stratigraphic unit of lower permeability. Transport of DNAPL will therefore be largely dependent on the gradient of the stratigraphy. Occasionally, the directional gradient of an impermeable stratigraphic unit may be different than the direction of ground-water flow as illustrated in Figure 13a. This may result in the migration of the continuous phase DNAPL in a direction different from the ground-water flow. Nonhorizontal stratigraphic units with varying hydraulic conductivity may also convey DNAPL in a different direction than ground-water flow, and at different rates (refer to Figure 13b). Determination of the direction of impermeable stratigraphic units will therefore provide useful information concerning the direction of DNAPL transport.

Similar to the unsaturated zone, the saturated zone also contains a complex distribution of preferential pathways from cracks, fractures, joints, etc. DNAPL introduced into such formations correspondingly follow the complex network of pathways through an otherwise relatively impermeable rock material. Other pathways which may behave as vertical conduits for DNAPL include root holes, stratigraphic windows, disposal wells, unsealed geotechnical boreholes, improperly sealed hydrogeological investigation sampling holes and monitoring wells, and old uncased/unsealed water supply wells (72). Transport of the DNAPL may migrate very rapidly in these open conduits or follow Darcian flow in the surrounding porous media or porous media filled fractures. A relatively small volume of DNAPL can move deep into a fractured system due to the low relative capacity of the fractured system. Consequently, fractured clay or rock stratigraphic units, which are often considered lower DNAPL boundary conditions, may have preferential pathways leading to lower formations, as depicted in Figure 14. Careful inspection of soil cores at one Superfund site indicated that DNAPL flow mainly occurred through preferential pathways and was not uniformly distributed throughout the soil mass (8). Due to the complex

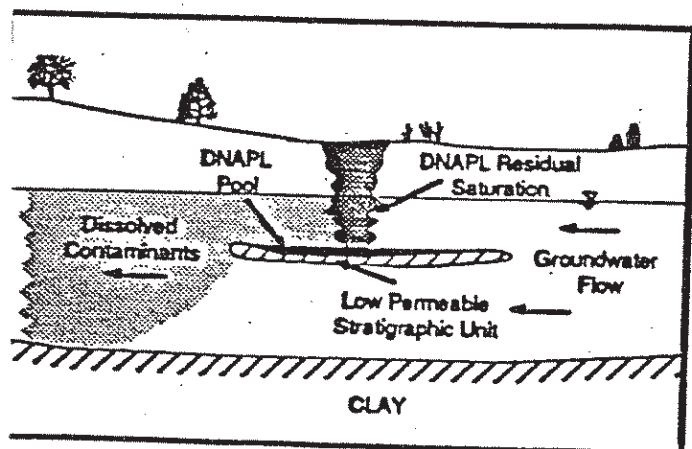


Figure 11. Perched DNAPL reservoir.

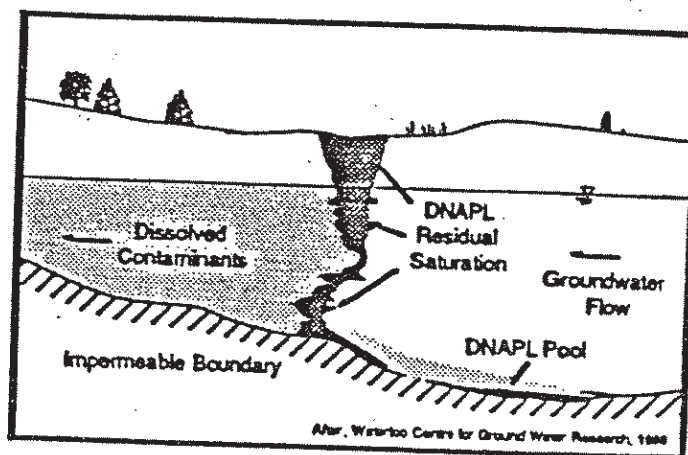


Figure 13a. Stratigraphic gradient different from ground water gradient results in a different direction of flow of the ground water and continuous phase DNAPL.

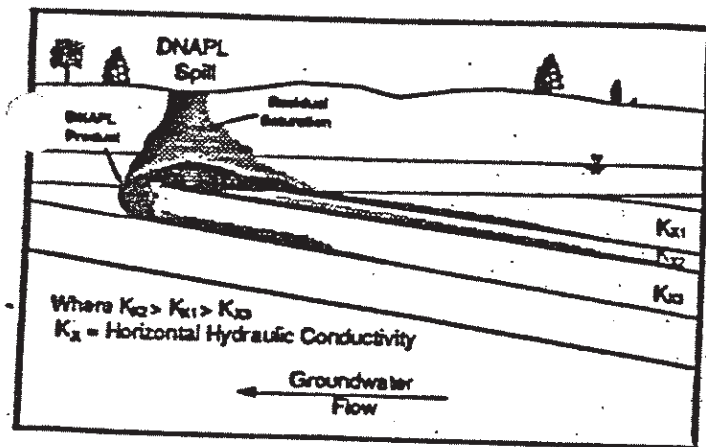


Figure 13b. Non-horizontal stratigraphic units with variable hydraulic conductivity may convey DNAPL in a different direction than the ground water flow direction.

distribution of preferential pathways, characterization of the volume distribution of the DNAPL is difficult.

Important DNAPL Transport and Fate Parameters

There are several characteristics associated with both the subsurface media and the DNAPL which largely determine the fate and transport of the DNAPL. A brief discussion of these parameters is included to help identify the specific details of PL transport mechanisms. Several of the distinctive DNAPL phenomena observed on the field-scale relates back to phenomena at the pore-scale. Therefore, it is important to understand the principles from the pore-scale level to develop an understanding of field-scale observations, which is the scale at which much of the Superfund work occurs in. A more complete and comprehensive review of these parameters is available (2,36,71).

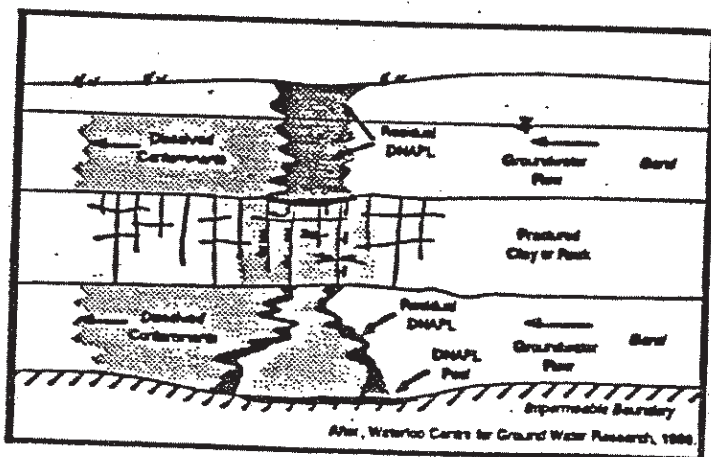


Figure 14. DNAPL transport in fracture and porous media stratigraphic units.

DNAPL Characteristics

Density

Fluid density is defined as the mass of fluid per unit volume, i.e. g/cm^3 . Density of an immiscible hydrocarbon fluid is the parameter which delineates LNAPL's from DNAPL's. The property varies not only with molecular weight but also molecular interaction and structure. In general, the density varies with temperature and pressure (2). Equivalent methods of expressing density are specific weight and specific gravity. The specific weight is defined as the weight of fluid per unit volume, i.e. lb/ft^3 . The specific gravity (S.G.) or the relative density of a fluid is defined as the ratio of the weight of a given volume of substance at a specified temperature to the weight of the same volume of water at a given temperature (31). The S.G. is a relative indicator which ultimately determines whether the fluid will float ($\text{S.G.} < 1.0$) on, or penetrate into ($\text{S.G.} > 1.0$) the water table. Table 1 contains a list of compounds with a density greater than one that are considered DNAPL's. Note, however, that while the specific gravity of pentachlorophenol and the non-halogenated semi-volatiles is greater than 1.00, these compounds are a solid at room temperature and would not be expected to be found as an immiscible phase liquid at wood preserving sites but are commonly found as contaminants. Pentachlorophenol is commonly used as a wood preservative and is typically dissolved (4-7%) in No. 2 or 3 fuel oil.

Viscosity

The viscosity of a fluid is a measure of its resistance to flow. Molecular cohesion is the main cause of viscosity. As the temperature increases in a liquid, the cohesive forces decrease and the absolute viscosity decreases. The lower the viscosity, the more readily a fluid will penetrate a porous media. The hydraulic conductivity of porous media is function of both the density and viscosity of the fluid as indicated in equation [1]. It is apparent from this equation that fluids with either a viscosity less than water or fluids with a density greater than water have the potential to be more mobile in the subsurface, than water.

$$K = \frac{k \rho g}{\mu} \quad \text{where,} \quad \begin{array}{l} K = \text{hydraulic conductivity} \\ k = \text{intrinsic permeability} \\ \rho = \text{fluid mass density} \\ g = \text{gravity} \\ \mu = \text{dynamic (absolute) viscosity} \end{array} \quad [1]$$

Results from laboratory experiments indicated that several chlorinated hydrocarbons which have low viscosity (methylene chloride, perchloroethylene, 1,1,1-TCA, TCE) will infiltrate into soil notably faster than will water (47). The relative value of NAPL viscosity and density, to water, indicates how fast it will flow in porous media (100% saturated) with respect to water. For example, several low viscosity chlorinated hydrocarbons (TCE, tetrachloroethylene, 1,1,1-TCA, Methylene Chloride, Chloroform, Carbon Tetrachloride, refer to Table 1) will flow 1.5-3.0 times as fast as water and higher viscosity compounds including light heating oil, diesel fuel, jet fuel, and crude oil (i.e. LNAPL's) will flow 2-10 times slower than water (45). Both coal tar and creosote typically have a specific gravity greater than one and a viscosity greater than water. It is interesting to note

that the viscosity of NAPL may change with time (36). As fresh crude oils lose the lighter volatile components from evaporation, the oils become more viscous as the heavier components compose a larger fraction of the oily mixture resulting in an increase in viscosity.

Solubility

When an organic chemical is in physical contact with water, the organic chemical will partition into the aqueous phase. The equilibrium concentration of the organic chemical in the aqueous phase is referred to as its solubility. Table 1 presents the solubility of several of the most commonly found DNAPL's at EPA Superfund Sites. The solubility of organic compounds varies considerably from the infinitely miscible compounds, including alcohols (ethanol, methanol) to extremely low solubility compounds such as polynuclear aromatic compounds.

Numerous variables influence the solubility of organic compounds. The pH may effect the solubility of some organic compounds. Organic acids may be expected to increase in solubility with increasing pH, while organic bases may act in the opposite way (31). For example, pentachlorophenol is an acid which is ionized at higher pH's. In the ionized form, pentachlorophenol would be more soluble in water (59). Solubility in water is a function of the temperature, but the strength and direction of this function varies. The presence of dissolved salts or minerals in water leads to moderate decreases in solubility (31). In a mixed solvent system, consisting of water and one or more water-miscible compounds, as the fraction of the cosolvent in the mixture increases, the solubility of the organic chemical increases exponentially (12). In general, the greater the molecular weight and structural complexity of the organic compound, the lower the solubility.

Organic compounds are only rarely found in ground water at concentrations approaching their solubility limits, even when organic liquid phases are known or suspected to be present. The observed concentrations are usually more than a factor of 10 lower than the solubility presumably due to diffusional limitations of dissolution and the dilution of the dissolved organic contaminants by dispersion (74). This has also been attributed to: reduced solubility due to the presence of other soluble compounds, the heterogeneous distribution of DNAPL in the subsurface, and dilution from monitoring wells with long take lengths (10). Detection of DNAPL components in the subsurface below the solubility should clearly not be interpreted as a negative indicator for the presence of DNAPL.

In a DNAPL spill scenario where the DNAPL or its vapors are in contact with the ground water, the concentration of the soluble phase components may range from non-detectable up to the solubility of the compound. The rate of dissolution has been expressed as a function of the properties of the DNAPL components (solubility), ground water flow conditions, concentration differential between the actual and solubility, and the contact area between the DNAPL and the ground water (30). The contact area is expected to be heterogeneous and difficult to quantify. Additionally, as the time of contact increases between the DNAPL and the water, the concentration in the aqueous phase increases.

Vapor Pressure

The vapor pressure is that characteristic of the organic chemical which determines how readily vapors volatilize or evaporate from the pure phase liquid. Specifically, the partial pressure exerted at the surface by these free molecules is known as the vapor pressure (30). Molecular activity in a liquid tends to free some surface molecules and this tendency towards vaporization is mainly dependent on temperature. The vapor pressure of DNAPL's can actually be greater than the vapor pressure of volatile organic compounds. For example, at 20 C, the ratio of the vapor pressures of TCE and benzene is 1.4 (1).

Volatility

The volatility of a compound is a measure of the transfer of the compound from the aqueous phase to the gaseous phase. The transfer process from the water to the atmosphere is dependent on the chemical and physical properties of the compound, the presence of other compounds, and the physical properties (velocity, turbulence, depth) of the water body and atmosphere above it. The factors that control volatilization are the solubility, molecular weight, vapor pressure, and the nature of the air-water interface through which it must pass (31). The Henry's constant is a valuable parameter which can be used to help evaluate the propensity of an organic compound to volatilize from the water. The Henry's law constant is defined as the vapor pressure divided by the aqueous solubility. Therefore, the greater the Henry's law constant, the greater the tendency to volatilize from the aqueous phase, refer to Table 1.

Interfacial Tension

The unique behavior of DNAPLs in porous media is largely attributed to the interfacial tension which exists between DNAPL and water, and between DNAPL and air. These interfacial tensions, result in distinct interfaces between these fluids at the pore-scale. When two immiscible liquids are in contact, there is an interfacial energy which exists between the fluids resulting in a physical interface. The interfacial energy arises from the difference between the inward attraction of the molecules in the interior of each phase and those at the surface of contact (2). The greater the interfacial tension between two immiscible liquids; the less likely emulsions will form; emulsions will be more stable if formed, and the better the phase separation after mixing. The magnitude of the interfacial tension is less than the larger of the surface tension values for the pure liquids, because the mutual attraction of unlike molecules at the interface reduces the large imbalance of forces (31). Interfacial tension decreases with increasing temperature, and may be affected by pH, surfactants, and gases in solution (36). When this force is encountered between a liquid and a gaseous phase, the same force is called the surface tension (66).

The displacement of water by DNAPL and the displacement of DNAPL by water in porous media often involves a phenomena referred to as immiscible fingering. The lower the interfacial tension between immiscible fluids, the greater the instability of the water:DNAPL interface and thus the greater the immiscible fingering (27). The distribution of the fingering effects in porous media has been reported to be a function of the density, viscosity, surface tension (27) and the displacement velocity

(13) of the fluids involved as well as the porous media heterogeneity (28).

Wettability

Wettability refers to the relative affinity of the soil for the various fluids - water, air, and the organic phase. On a solid surface, exposed to two different fluids, it can be inferred from the contact angle (66), also referred to as the wetting angle, refer to Figure 15. In general, if the wetting angle is less than 90 degrees, the fluid is said to be the wetting fluid. In this scenario, water will preferentially occupy the smaller pores and will be found on solid surfaces (14). When the wetting angle is near 90 degrees, neither fluid is preferentially attracted to the solid surfaces. If the wetting angle is greater than 90 degrees, the DNAPL is said to be the wetting fluid. The wetting angle is an indicator used to determine whether the porous material will be preferentially wetted by either the hydrocarbon or the aqueous phase (71). Wettability, therefore, describes the preferential spreading of one fluid over solid surfaces in a two-fluid system. The wetting angle, which is a measure of wettability, is a solid-liquid interaction and can actually be defined in terms of interfacial tensions (71). Several methods have been developed to measure the wetting angle (36,71). In most natural systems, water is the wetting fluid, and the immiscible fluid is the non-wetting fluid. Coal tar may be the exception (i.e. contact angle greater than 90 degrees), which is mainly attributed to the presence of surfactants (70). The wetting fluid will tend to coat the surface of grains and occupy smaller spaces (i.e. pore throats) in porous media, the non-wetting fluid will tend to be restricted to the largest openings (47).

The wetting angle depends on the character of the solid surface on which the test is conducted. The test is conducted on flat plates composed of minerals which are believed representative of the media, or on glass. Contact angle measurements for crude oil indicates that the wetting angles vary widely depending on the mineral surface (53). Soil and aquifer material are not composed of homogeneous mineral composition nor flat surfaces. The measured wetting angle can only be viewed as a qualitative indicator of wetting behavior.

The reader is recommended to refer to reference No. 82 for review of the basic principles and for various techniques to

measure the following DNAPL parameters: density, viscosity, interfacial tension, solubility, vapor pressure, and volatility.

Subsurface Media Characteristics

Capillary Force/Pressure

Capillary pressure is important in DNAPL transport because it largely determines the magnitude of the residual saturation that is left behind after a spill incident. The greater the capillary pressure, the greater the potential for residual saturation. In general, the capillary force increases in the following order; sand, silt, clay. Correspondingly, the residual saturation increases in the same order. Capillary pressure is a measure of the tendency of a porous medium to suck in the wetting fluid phase or to repel the nonwetting phase (2). Capillary forces are closely related to the wettability of the porous media. The preferential attraction of the wetting fluid to the solid surfaces cause that fluid to be drawn into the porous media. Capillary forces are due to both adhesion forces (the attractive force of liquid for the solids on the walls of the channels through which it moves) and cohesion forces (the attraction forces between the molecules of the liquid) (32). The capillary pressure depends on the geometry of the void space, the nature of solids and liquids, the degree of saturation (2) and in general, increases with a decrease the wetting angle and in pore size, and with the increase in the interfacial tension (71). All pores have some value of capillary pressure. Before a non-wetting fluid can enter porous media, the capillary pressure of the largest pores (smallest capillary pressure) must be exceeded. This minimum capillary pressure is called the entry pressure.

In the unsaturated zone, pore space may be occupied by water, air (vapors), or immiscible hydrocarbon. In this scenario, capillary pressure retains the water (wetting phase) mainly in the smaller pores where the capillary pressure is greatest. This restricts the migration of the DNAPL (non-wetting phase) through the larger pores unoccupied by water. Typically, DNAPL does not displace the pore water from the smaller pores. It is interesting to note that the migration of DNAPL through fine material (high capillary pressure) will be impeded upon reaching coarser material (low capillary pressure).

The capillary fringe will obstruct the entry of the DNAPL into the saturated zone. When a sufficient volume of DNAPL has been released and the "DNAPL pressure head" exceeds the water capillary pressure at the capillary fringe (entry pressure), the DNAPL will penetrate the water table. This is why DNAPL is sometimes observed to temporarily flatten out on top of the water table. Similarly, laboratory experiments have been conducted in which DNAPL (tetrachloroethylene) infiltrating through porous media was found to flow laterally and cascade off lenses too fine to penetrate (28), (refer to Figure 11). This was attributed to the inability of the DNAPL to overcome the high capillary pressure associated with the lenses. Logically, when "DNAPL pressure head" exceeds the capillary pressure, the DNAPL will penetrate into the smaller pores. These laboratory experiments are important because they illustrate that small differences in the capillary characteristics of porous media can induce significant lateral flow of non-wetting fluids.

A comprehensive investigation of capillary trapping and multiphase flow of organic liquids in unconsolidated porous media revealed many intricacies of this process in the vadose

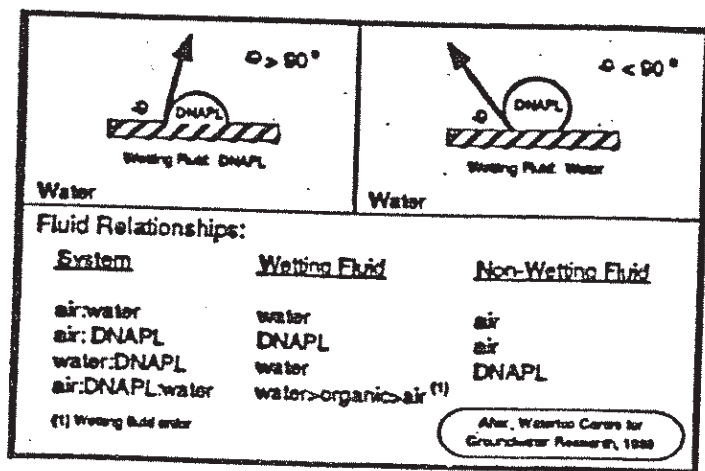


Figure 15. Wetting angle and typical wetting fluid relationships.

and saturated zone (66). An important note is that while capillary pressure is rarely measured at hazardous waste sites, the soil texture (sand, silt, clay) is usually recorded during drilling operations and soil surveys. This information, along with soil core analyses will help to delineate the stratigraphy and the volume distribution of NAPL.

Pore Size Distribution/Initial Moisture Content

In natural porous media, the geometry of the pore space is extremely irregular and complex (2). The heterogeneity of the subsurface environment i.e. the variability of the pore size distribution, directly affects the distribution of the capillary pressures along the interfaces between the aqueous and immiscible phases (50). In saturated column experiments, it was observed that NAPL preferentially traveled through strings of macropores, almost completely by-passing the water filled micropores (66). In the same study, a heterogeneous distribution of coarse and fine porous material was simulated. Most of the incoming organic liquid preferentially traveled through the coarse lens material.

In short term column drainage experiments, results indicated that the particle grain size is of primary importance in controlling the residual saturation of a gasoline hydrocarbon (19). Fine and coarse sands (dry) were found to have 55% and 14% residual saturation, respectively. The finer the sand, the greater the residual saturation. During these experiments, the residual saturation was reduced 20-30% in a medium sand and 50% in a fine sand when the sands were initially wet. Soil pore water held tightly by capillary forces in the small pores will limit the NAPL to the larger pores, and thus, result in lower residual saturation. In a similar laboratory (unsaturated) column study, the smaller the grain size used in the experiment, the greater the residual saturation of the NAPL (74). The residual saturation in the saturated column experiments was found to be greater than the unsaturated columns and was independent of the particle size distribution.

These observations follow traditional capillary force theory. Residual saturation resulting from a DNAPL spill in the unsaturated zone is highly dependent on the antecedent moisture content in the porous media. When the moisture content is low, the strong capillary forces in the smaller pores will tenaciously draw in and hold the DNAPL. When the moisture content is high, the capillary forces in the smaller pores will retain the soil pore water, and DNAPL residual saturation will mainly occur in the larger pores. Therefore, higher residual saturation can be expected in dryer soils. Correspondingly, NAPL will migrate further in a wetter soil, and the placement of NAPL from small pores is expected to be more difficult than from large pores.

Stratigraphic Gradient

NAPL migrating vertically will likely encounter a zone or stratigraphic unit of lower vertical permeability. A reduction in the vertical permeability of the porous media will induce lateral flow of the DNAPL. The gradient of the lower permeable stratigraphic unit will largely determine the direction in which the DNAPL will flow. This is applicable to both the saturated and unsaturated zones. As depicted in Figures 13a and 13b, the lateral direction of DNAPL flow may be in a different direction than ground-water flow.

Ground Water Flow Velocity

The ground water flow velocity is a dynamic stress parameter which tends to mobilize the hydrocarbon (39). As the ground water velocity increases, the dynamic pressure and viscous forces increase. Mobilization of DNAPL occurs when the viscous forces of the ground water acting on the DNAPL, exceeds the porous media capillary forces retaining the DNAPL.

Saturation Dependent Functions

Residual Saturation

Residual saturation is defined as the volume of hydrocarbon trapped in the pores relative to the total volume of pores (38) and therefore is measured as such (74). Residual saturation has also been described as the saturation at which NAPL becomes discontinuous and is immobilized by capillary forces (36). The values of residual saturation vary from as low as 0.75 - 1.25% for light oil in highly permeable media to as much as 20% for heavy oil (50). Residual saturation values have also been reported to range from 10% to 50% of the total pore space (39,74). Other researchers reported that residual saturation values appear to be relatively insensitive to fluid properties and very sensitive to soil properties (and heterogeneities) (66). Laboratory studies conducted to predict the residual saturation in soils with similar texture and grain size distribution yielded significantly different values. It was concluded that minor amounts of clay or silt in a soil may play a significant role in the observed values.

In the unsaturated zone during low moisture conditions, the DNAPL residual saturation will wet the grains in a pendular state (a ring of liquid wrapped around the contact point of a pair of adjacent grains). During high moisture conditions, the wetting fluid, which is typically water, will preferentially occupy the pendular area of adjacent grains and the hydrocarbon will occupy other available pore space, possibly as isolated droplets. In the saturated zone, the DNAPL residual saturation will be present as isolated drops in the open pores (47). Furthermore, results of laboratory experimentation indicated that residual saturation increased with decreasing hydraulic conductivity in both the saturated and unsaturated zones and that the residual saturation is greatest in the saturated zone. Laboratory experiments indicated that vadose zone residual saturation was roughly one third of the residual saturation in the saturated zone (66). The increase in residual saturation in the saturated zone is due to the following: [1] the fluid density ratio (DNAPL:air versus DNAPL:water above and below the water table, respectively) favors greater drainage in the vadose zone; [2] as the non-wetting fluid in most saturated media, NAPL is trapped in the larger pores; and, [3] as the wetting fluid in the vadose zone, NAPL tends to spread into adjacent pores and leave a lower residual content behind, a process that is inhibited in the saturated zone (36). Thus, the capacity for retention of DNAPLs in the unsaturated zone is less than the saturated zone.

Relative Permeability

Relative permeability is defined as the ratio of the permeability of a fluid at a given saturation to its permeability at 100% saturation. Thus it can have a value between 0 and 1 (71).

Figure 16 illustrates a relative permeability graph for a two fluid phase system showing the relationship between the observed permeability of each fluid for various saturations to that of the observed permeability if the sample were 100% saturated with a fluid (73). The three regions of this graph are explained as follows (71): Region I has a high saturation of DNAPL and is considered a continuous phase while the water is a discontinuous phase, therefore, water permeability is low. Assuming the DNAPL is the non-wetting fluid, water would fill the smaller capillaries and flow through small irregular pores. In Region II, both water and DNAPL are continuous phases although not necessarily in the same pores. Both water and

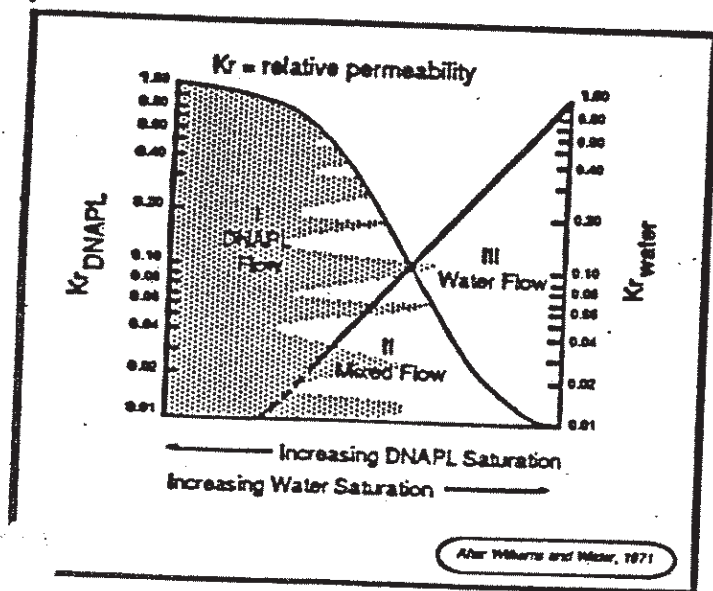


Figure 16. Relative permeability graph.

DNAPL flow simultaneously. However, as saturation of either phase increases, the relative permeability of the other phase correspondingly decreases. Region III exhibits a high saturation of water while the DNAPL phase is mainly discontinuous. Water flow dominates this region and there is little or no flow of DNAPL.

Both fluids flow through only a part of the pore space and thus only a part of the cross section under consideration is available for flow of each fluid. Therefore, the discharge of each fluid must be lower corresponding to its proportion of the cross sectional area (46).

Figure 17 is another relative permeability graph which demonstrates several points. Small increases in DNAPL saturation results in a significant reduction in the relative permeability of water. However, a small increase in water saturation does not result in a significant reduction in DNAPL relative permeability. This figure identifies two points, SO1 and SO2, where the saturation of the DNAPL and the water are greater than 0 before there is a relative permeability for this fluid. The two fluids hinder the movement of the other to different degrees and both must reach a minimum saturation before they achieve any mobility at all (47). These minimum saturations, for the water and DNAPL, are identified as irreducible and residual saturation, respectively.

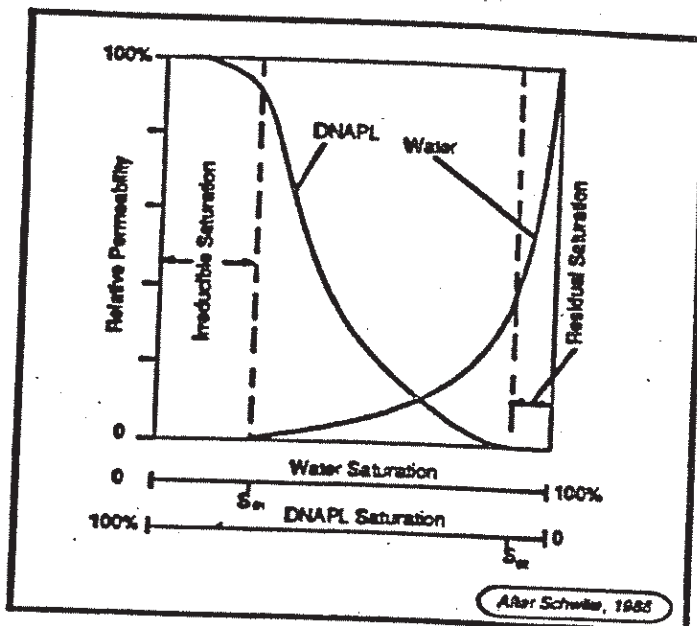


Figure 17. The relative permeability curves for water and a DNAPL in a porous medium as a function of the pore space saturation.

Site Characterization for DNAPL

Characterization of the subsurface environment at hazardous waste sites containing DNAPL is complex and will likely be expensive. Specific details associated with the volume and timing of the DNAPL release are usually poor or are not available and subsurface heterogeneity is responsible for the complicated and unpredictable migration pathway of subsurface DNAPL transport. As discussed previously, slight changes in vertical permeability may induce a significant horizontal component to DNAPL migration.

Site characterization typically involves a significant investment in ground-water analyses. Although analysis of ground water provides useful information on the distribution of the soluble components of the DNAPL, the presence of other phases of the DNAPL may go unrecognized. The investigation must, therefore, be more detailed to obtain information concerning the phase distribution of the DNAPL at a site. Site characterization may require analyses on all four phases (aqueous, gaseous, solid, immiscible) to yield the appropriate information (refer to Table 2). In brief, data collected on the various phases must be compiled, evaluated and used to help identify: where the contaminant is presently located; where it has been; what phases it occurs in; and what direction the mobile phases may be going. A comprehensive review of site characterization for subsurface investigations is available (68). Development of monitoring and remediation strategies can be focused more effectively and efficiently after a clear definition of the phase distribution has been completed.

Ground Water

Ground water analyses for organic compounds, in conjunction with ground water flow direction data, has repeatedly been used to: delineate the extent of ground water contamination from DNAPL; determine the direction of plume migration; and

Table 2 - Phase Distribution of DNAPL in the Subsurface

MATRIX	PHASE
1. ground water	aqueous - soluble components of DNAPL
2. soil/aquifer material	solid - adsorbed components of DNAPL on solid phase material
3. DNAPL	immiscible - continuous phase (mobile), residual saturation (immobile)
4. soil gas	gaseous - volatile components

to identify probable DNAPL source area(s). While this approach has been used successfully to characterize the distribution of contaminants in the subsurface, there are limitations. For example, since DNAPL and ground water may flow in different directions, as indicated in Figures 13a and 13b, ground water analyses may not necessarily identify the direction of DNAPL migration.

Ground water analyses may be useful to identify probable DNAPL source areas, but, estimating the volume of DNAPL in the subsurface is limited using this approach. Soluble phase components of DNAPL are rarely found in excess of 10% of the solubility even when organic liquids are known or suspected to be present. The concentration of soluble DNAPL components in the ground water is not only a function the amount of DNAPL present, but also the chemical and physical characteristics of the DNAPL, the contact area and time between the ground water and DNAPL, and numerous transport and fate parameters (retardation, biodegradation, dispersion, etc.). One technique has been developed using chemical ratios in the ground water as a means of source identification and contaminant fate prediction (18).

Soil/Aquifer Material

Exploratory Borings

Physical and chemical analyses of soil and aquifer material (soil cuttings, cores) from exploratory borings will provide useful information in the delineation of the horizontal and vertical mass distribution of DNAPL. While simple visual examination for physical presence or absence of contamination might seem like a worthwhile technique, it can be deceiving and does nothing to sort out the various liquid phases and their relationship to each other (71). A quantitative approach is necessary to determine DNAPL distribution.

Soil cuttings or core material brought to the surface from exploratory borings can be screened initially to help delineate the depth at which volatile components from the various phases of the hydrocarbon exists. The organic vapor analyzer and the HNU are small portable instruments that can detect and identify volatile compounds in the air. These methods are used initially to screen subsurface materials for volatile components of DNAPL. Identification of individual compounds and their concentrations may be confirmed by other, more precise, analyses.

Analysis of the soil or aquifer material by more accurate means, such as gas chromatography or high pressure liquid chromatography, will take longer but will provide more specific information on a larger group of organic compounds, i.e., volatile/non-volatile, and on specific compounds. This information is necessary to help fix the horizontal and vertical mass distribution of the contaminant and to help delineate the phase distribution. These analyses do not distinguish between soluble, sorbed or free-phase hydrocarbon, however; a low relative concentration indicates that the contaminant may mainly be present in the gaseous or aqueous phases; and a high relative concentration indicates the presence of sorbed contaminant or free phase liquid either as continuous-phase or residual saturation. A more rigorous set of analyses is required to distinguish between the various phases.

Additional tests to identify the presence of NAPL in soil or aquifer core sample are currently undeveloped and research in this area is warranted. Squeezing and immiscible displacement techniques have been used to obtain the pore water from cores (40). Other methods of phase separation involving vacuum or centrifugation may also be developed for this use. A paint filter test was proposed in one Superfund DNAPL field investigation where aquifer cores were placed in a filter/funnel apparatus, water was added, and the filtrate was examined for separate phases. These core analysis techniques have potential to provide valuable field data to characterize NAPL distribution.

Cone Penetrometer

The cone penetrometer (ASTM D3441-86)(69) has been used for some time to supply data on the engineering properties of soils. Recently, the application of this technology has made the leap to the hazardous waste arena. The resistance of the formation is measured by the cone penetrometer as it is driven vertically into the subsurface. The resistance is interpreted as a measure of pore pressure, and thus provides information on the relative stratigraphic nature of the subsurface. Petroleum and chlorinated hydrocarbon plumes can be detected most effectively when the cone penetrometer is used in conjunction with in-situ sensing technologies (48). Features of the cone penetrometer include: a continuous reading of the stratigraphy/permeability; in-situ measurement; immediate results are available; time requirements are minimal; vertical accuracy of stratigraphic composition is high; ground-water samples can be collected in-situ; and the cost is relatively low.

Data from the cone penetrometer can be used to delineate probable pathways of DNAPL transport. This is accomplished by identifying permeability profiles in the subsurface. A zone of low permeability underlying a more permeable stratigraphic unit will likely impede vertical transport of the DNAPL. Where such a scenario is found, a collection of DNAPL is probable and further steps can be implemented to more accurately and economically investigate and confirm such an occurrence. This general approach has successfully been implemented at one Superfund site (8).

DNAPL

Well Level Measurements

In an effort to delineate the horizontal and vertical extent of the DNAPL at a spill site, it is important to determine the elevation

of DNAPL in the subsurface. Monitoring DNAPL elevation over time will indicate the mobility of the DNAPL. There are several methods that can be used to determine the presence of DNAPL in a monitoring well. One method relies on the difference in electrical conductivity between the DNAPL and water. A conductivity or resistivity sensor is lowered into the well and a profile is measured. The interface of the DNAPL is accurately determined when the difference in conductivity is detected between the two fluids. This instrument may also be used to delineate LNAPL, also. A transparent, bottom-loading bailer can also be used to measure the thickness (and to sample) of DNAPL in a well (36). The transparent bailer is raised to the surface and the thickness of the DNAPL is made by visual measurement.

Several laboratory and field studies have been performed which investigate the anomaly between the actual and measured LNAPL levels in ground-water wells (15,16,24,25). The anomaly between actual and measured NAPL thickness in the subsurface is also applicable to DNAPL, but for different reasons. The location of the screening interval is the key to understanding both scenarios. First, if the well screen interval is situated entirely in the DNAPL layer, and the hydrostatic head (water) in the well is reduced by pumping or bailing, then to maintain hydrostatic equilibrium, the DNAPL will rise in the well (36,44,71) (refer to Figure 18). Secondly, if the well screen extends into the barrier layer, the DNAPL measured thickness will exceed that in the formation by the length of the well below the barrier surface (36) (refer to Figure 19). Both of these scenarios will result in a greater DNAPL thickness in the well and thus a false indication (overestimate) of the actual DNAPL thickness will result. One of the main purposes of the monitoring well in a DNAPL investigation is to provide information on the thickness of the DNAPL in the aquifer. Therefore, construction of the well screen should intercept the ground water:DNAPL interface and the lower end of the screen should be placed as close as possible to the impermeable stratigraphic unit.

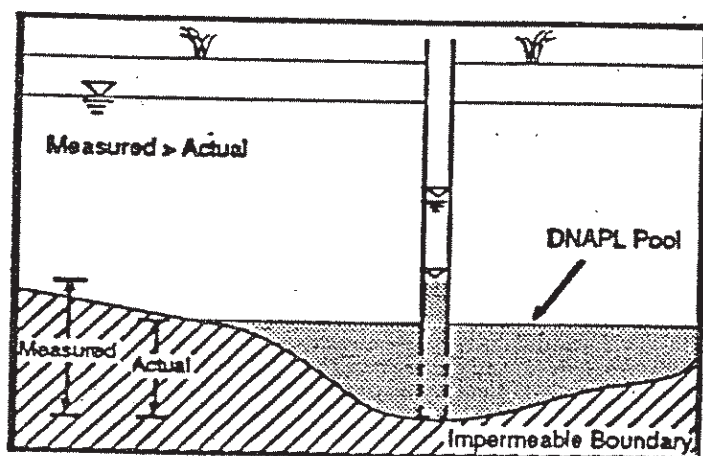


Figure 18. A well screened only in the DNAPL in conjunction with lower hydrostatic head (i.e. water) in the well may result in an overestimation of DNAPL thickness.

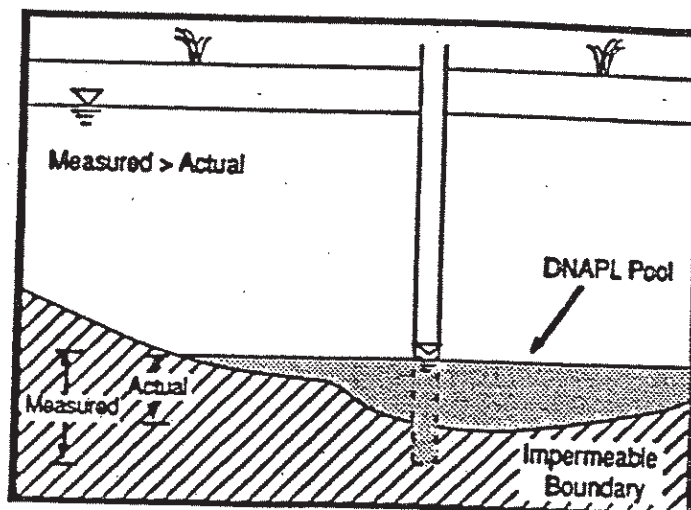


Figure 19. A well screened into an impermeable boundary may result in an over-estimation of the DNAPL thickness.

DNAPL Sampling

Sampling of DNAPL from a well is necessary to perform chemical and physical analyses on the sample. Two of the most common methods used to retrieve a DNAPL sample from a monitoring well are the peristaltic pump and the bailer. A peristaltic pump can be used to collect a sample if the DNAPL is not beyond the effective reach of the pump, which is typically less than 25 feet. The best method to sample DNAPL is to use a double check valve bailer. The key to sample collection is controlled, slow lowering (and raising) of the bailer to the bottom of the well (57). The dense phase should be collected prior to purging activities.

Soil-Gas Surveys

A soil-gas survey refers to the analysis of the soil air phase as a means to delineate underground contamination from volatile organic chemicals and several techniques have been developed (34,52). This investigative tool is mainly used as a preliminary screening procedure to delineate the areal extent of volatile organic compounds in the soil and ground water. This method is quick, less expensive than drilling wells and can provide greater plume resolution (33).

Data from a soil-gas survey is a valuable aid in the development of a more detailed subsurface investigation where ground water monitoring wells and exploratory borings are strategically located for further site characterization. There are limitations to soil-gas surveys (26,52) and data interpretation must be performed carefully (35,49). Soil-gas investigations have mainly been conducted to identify the location of the organic contaminants in ground water. At the time of this publication, the scientific literature did not contain information specifically applicable to the delineation of DNAPL from soil-gas survey data. However, it is surmisable that soil-gas surveys can be used to help delineate DNAPL residual saturation in the unsaturated zone or the location of perched DNAPL reservoirs.

Miscellaneous

The vertical migration of DNAPL in the saturated zone will eventually be challenged by a low permeability stratigraphic unit. According to the principles of capillary pressure, the lower permeability unit will exhibit a greater capillary pressure. Displacement of water by DNAPL requires that the hydrostatic force from the mounding DNAPL exceed the capillary force of the low permeability unit. The Hobson formula is used to compute the critical height calculation to overcome the capillary pressure under different pore size conditions (70).

In an effort to minimize further DNAPL contamination as a result of drilling investigations, precautionary steps should be taken. Penetration of DNAPL reservoirs in the subsurface during drilling activities offers a conduit for the DNAPL to migrate vertically into previously uncontaminated areas. It is very easy to unknowingly drill through a DNAPL pool and the bed it sits on, causing the pool to drain down the hole into a deeper part of the aquifer or into a different aquifer (32). Special attention to grouting and sealing details during and after drilling operations will help prevent cross-contamination.

Precautionary efforts should also be considered when a DNAPL reservoir is encountered during drilling operations. The recommended approach is to cease drilling operations and install a well screen over the DNAPL zone and cease further drilling activities in the well. If it is necessary to drill deeper, construction of an adjacent well is recommended. Alternatively, if it is not necessary to screen off that interval, it is recommended to carefully seal off the DNAPL zone prior to drilling deeper.

Well construction material compatibility with DNAPL should be investigated to minimize downhole material failure. A construction material compatibility review and possible testing will prevent the costly failure of well construction material. The manufacturers of well construction material are likely to have the most extensive compatibility data and information available.

Remediation

Remediation of DNAPL mainly involves physical removal by either pumping or trench-drainline systems. Removal of DNAPL early in the remediation process will eliminate the main source of contaminants. This step will substantially improve the overall recovery efficiency of the various DNAPL phases including the long term pump and treat remediation efforts for soluble components. Remediation technologies such as vacuum extraction, biodegradation, ground water pumping, and soil flushing is mainly directed at the immobile DNAPL and the various phases in which its components occur. Physical barriers can be used in an effort to minimize further migration of the DNAPL.

Clean-up of DNAPL can involve sizable expenditures: they are difficult to extract and the technology for their removal is just evolving (43). Historically, field recovery efforts usually proceed with a poor understanding of the volume distribution of the DNAPL. This reflects the difficulties involved in adequate site characterization, poor documentation of the release, and the complexity associated with the DNAPL transport in the subsurface.

Pumping Systems

Pumping represents an important measure to stop the mobile DNAPL from migrating as a separate phase by creating a hydraulic containment and by removal of DNAPL (44). Very simply, DNAPL recovery is highly dependent on whether the DNAPL can be located in the subsurface. The best recovery scenario is one in which the DNAPL is continuous and has collected as a reservoir in a shallow, subsurface impermeable depression. Once the DNAPL has been located and recovery wells are properly installed, pumping of pure phase DNAPL is a possible option but depends largely on site specific conditions which include, but are not limited to: DNAPL thickness, viscosity, and permeability.

Many DNAPL reservoirs in the subsurface are of limited volume and areal extent. Therefore, it can be expected that both the level of DNAPL (saturated thickness) in the well will decline from the prepumping position and the percentage of DNAPL in the DNAPL:water mixture will decrease rather rapidly. Correspondingly, DNAPL recovery efficiency decreases. Field results indicate that recovery wells screened only in the DNAPL layer will maintain maximum DNAPL:water ratios (102). Well diameter was not found to influence long term DNAPL recovery; however, large diameter wells allow high volume pumping for short durations; and small diameter wells result in lower DNAPL:water mixtures and greater drawdown.

An enhanced DNAPL recovery scheme may be used to improve recovery efficiency. An additional well is constructed with a screen interval in the ground water zone located vertically upward from the DNAPL screen intake. Ground water is withdrawn from the upper screen which results in an upwelling of the DNAPL (70), refer to Figure 20. The upwelling of the DNAPL, coal tar in this case, improved the rate (twofold) at which the coal tar was recovered resulting in a more efficient operation. The ground water withdrawal rate must be carefully determined; too much will cause the coal tar from rising excessively and being either mixed (emulsions) with or suppressed by the higher water velocity above; too low will not

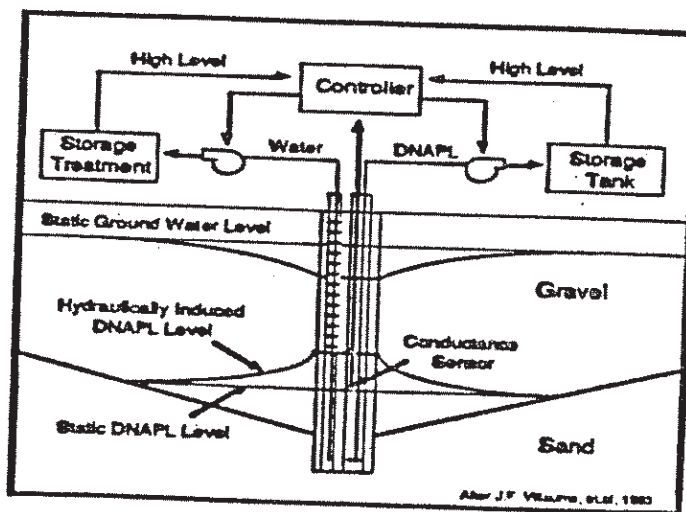


Figure 20. A DNAPL recovery system where deliberate upwelling of the static coal-tar surface is used to increase the flow of product into the recovery wells.

caused upwelling. An estimate of this upwelling can be calculated using the simplified Ghyben-Herzberg Principle for ideal conditions (4). Laboratory studies indicated that diethyl phthalate (1.19 g/cc) recovery rate was doubled or tripled over the conventional, non-upconing, recovery scheme (75). A similar application of this technique was used to increase the level of DNAPL (solvents) in a sandstone bedrock formation (11). Other enhanced DNAPL recovery techniques were implemented utilizing both water flooding and wellbore vacuum. Essentially, this minimized drawdown, allowing a maximum pumping rate of the DNAPL-water mixture. Both techniques offered significant advantages in terms of the rate and potential degree of DNAPL removal (8).

The highly corrosive nature of some DNAPL's may increase maintenance problems associated with the recovery system. A design consideration during any DNAPL recovery program should include a material compatibility review to minimize downhole failures. This is applicable to the well construction material and the various appurtenances of the recovery system. Manufacturers of the construction material would most likely have the best compatibility information available.

While most researchers agree that the residual saturation of immiscible hydrocarbon droplets in porous media are immobile, researchers have investigated the mobility of residual saturation in porous media for enhanced oil recovery and for NAPL remediation at spill sites. Specifically, this includes a complex interplay between four forces (viscous, gravity, capillary, buoyancy). These forces are dependent on both the chemical and physical characteristics of the DNAPL and porous media. The mobilization of residual saturation hinges on either increasing the ground water velocity which increases the viscous forces between the residual saturation and the ground water, or decreasing the interfacial tension between the residual saturation and the ground water which decreases the capillary forces.

The capillary number is an empirical relationship which measures the ratio between the controlling dynamic stresses (absolute viscosity and ground water velocity) and static stresses (interfacial tension) of the residual saturation (39). The former are the viscous stresses and the dynamic pressure in the water which tend to move the oil. The latter are the capillary stresses in the curved water/oil interfaces which tend to hold the oil in place. As the capillary number is increased, the mobility of the residual saturation increases. In a laboratory column study, the capillary number had to be increased two orders of magnitude from when motion was initiated to complete displacement of the hydrocarbon in a sandstone core (74). In a glass bead packed column, only one order of magnitude increase was required. However, a higher capillary number was required to initiate mobility. The difference in mobility between the two columns was attributed to the pore geometry, i.e. size, shape.

There are limitations to residual saturation mobilization. The ground water gradient (dh/dl) necessary to obtain the critical capillary number to initiate blob mobilization would be 0.24. To obtain complete NAPL removal would require a gradient of 18 (3). Ground water gradients of this magnitude are unrealistic. Another estimate of the gradient necessary to mobilize carbon tetrachloride in a fine gravel and medium sand was 0.09 and 0.2 respectively (74). The former gradient is steep but not unreasonable and the latter gradient is very steep and

impractical to achieve in the field. The same researchers concluded from more recent, comprehensive studies, that the earlier predictions were optimistic, and that the gradient necessary to mobilize residual organic liquid is clearly impractical (66). Another limitation is that along with residual saturation mobilization, the NAPL blobs disperse into smaller blobs and that the blob distribution was dependent on the resulting capillary number (6). Recovery of the NAPL residual saturation by pumping ground water may be more feasible where the porous media is coarse and capillary forces are low, i.e. coarse sands and gravel. However, even in this scenario, it is expected that the radius of residual saturation mobilization would be narrow.

It is held in petroleum engineering theory that the only practical means of raising the capillary number dramatically is by lowering the interfacial tension (39) and that this can be achieved by using surfactants (66). Surfactants reduce the interfacial tension between two liquids, and therefore, are injected into the subsurface for enhanced recovery of immiscible hydrocarbons. In laboratory experiments, surfactant flushing solutions produced dramatic gains in flushing even after substantial water flushing had taken place (54). Unfortunately, surfactants can be quite expensive and cost prohibitive in NAPL recovery operations. Surfactants are usually polymeric in nature and a surfactant residue may be left behind in the porous media which may not be environmentally acceptable. Additionally, surfactants may be alkaline and thus effect the pH of the subsurface environment. It has been suggested that such a surfactant may inhibit bacterial metabolism and thus preclude subsequent use of biological technologies at the site. Significant research in this area is currently underway which may uncover information improving the economics and feasibility of this promising technology.

In summary, practical considerations and recommendations in mobilization and recovery of residual saturation include the following: more effective in very coarse porous media i.e. coarse sands and gravel; installation of recovery wells at the source to minimize flow path distance; large volume of water to treat/dispose at the surface; compounds with high interfacial tension or viscosity will be difficult to mobilize; implementation of linear one-dimensional sweeps through the zones of residual saturation (74) and surfactants will optimize recovery.

Pumping the soluble components (aqueous phase) of DNAPL from the immiscible (continuous and residual saturation), solid (sorbed), and gaseous phases has been perhaps one of the most effective means to date to both recover DNAPL from the subsurface and to prevent plume migration. Recovery of soluble components quite often has been the only remediation means available. This is attributed to the inability to locate recoverable DNAPL pools and due to low DNAPL yielding formations. The basic principles and theory of pump and treat technology and the successes and failures have been summarized in other publications (64,67) and is beyond the scope of this publication.

Pumping solubilized DNAPL components from fractured rock aquifers historically has been plagued with a poor recovery efficiency. Although the rock matrix has a relatively small intergranular porosity, it is commonly large enough to allow dissolved contaminants from the fractures to enter the matrix by diffusion and be stored there by adsorption (32). The

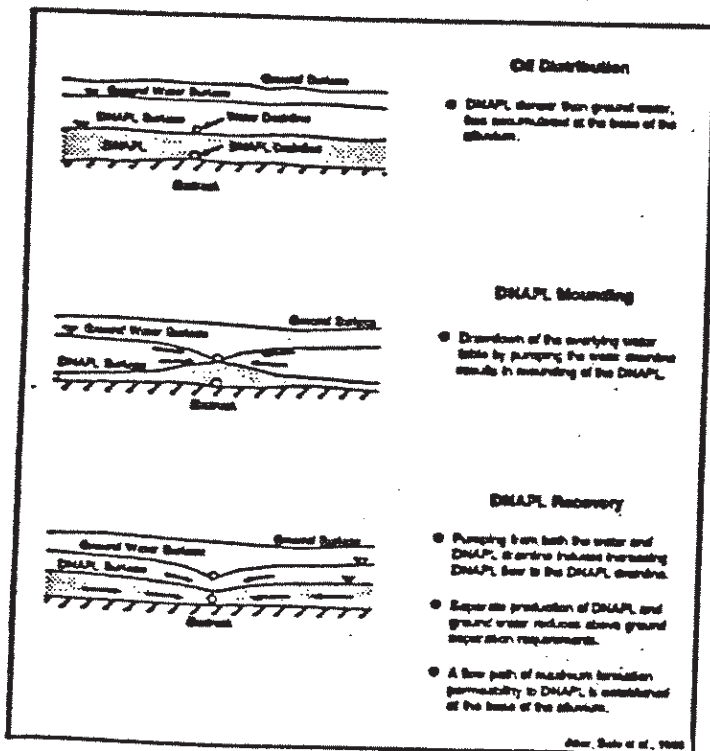


Figure 21. Trench recovery system of DNAPL utilizing the dual drainline concept.

release of these components is expected to be a slow diffusion dominated process. This is because little or no water flushes through dead-end fracture segments or through the porous, impervious rock matrix. Therefore, clean-up potential is estimated to be less than that expected for sand and gravel aquifers.

Trench Systems

Trench systems have also been used successfully to recover DNAPL and are used when the reservoir is located near the ground surface. Trench systems are also effective when the DNAPL is of limited thickness. Recovery lines are placed horizontally on top of the impermeable stratigraphic unit. DNAPL flows into the collection trenches and seep into the recovery lines. The lines usually drain to a collection sump where the DNAPL is pumped to the surface. Similar to the pumping system, an enhanced DNAPL recovery scheme may be implemented using drain lines to improve recovery efficiency. This "dual drain line system" (41) utilizes a drain line located in the ground water vertically upward from the DNAPL. Ground water is withdrawn from the upper screen which results in an upwelling of the DNAPL which is collected in the lower line, refer to Figure 21. This increases the hydrostatic head of the DNAPL. Excessive pumping of either single or dual drain line systems may result in the ground water "pinching off" the flow of DNAPL to the drain line. An advantage of the dual drain system is that the oil:water separation requirements at the surface are reduced.

Vacuum Extraction

Soil vacuum extraction (SVE) is a remediation technology which involves applying a vacuum to unsaturated subsurface strata to induce air flow. Figure 22 illustrates that the volatile contaminants present in the contaminated strata will evaporate and the vapors are recovered at the surface and treated. Common methods of treatment include granular activated carbon, catalytic oxidation, and direct combustion. SVE can effectively remove DNAPL present as residual saturation. In general, vacuum extraction is expected to be more applicable for the chlorinated solvents (PCE, TCE, DCE) than the polycyclic aromatic compounds (wood preserving wastes, coal tars, etc.). This technology is most effective to remove DNAPL residual saturation and soluble components in the unsaturated zone. When DNAPL is present in perched pools (Figure 12) it is more effective to remove DNAPL in the unsaturated zone prior to the implementation of SVE. The same strategy is applicable in the saturated zone where DNAPL removal by SVE is attempted concomitantly with lowering the water table. Upon lowering the water table, SVE can be used to remove the remnant volatile wastes not previously recovered. Often, the precise location of the DNAPL is unknown; therefore, SVE can be used to remediate the general areas where the presence of DNAPL is suspected. Removal of DNAPL by SVE is not expected to be as rapid as direct removal of the pure phase compound. One advantage of SVE however, is that the precise location of the DNAPL need not be known.

Important parameters influencing the efficacy of SVE concern both the DNAPL and porous media. Porous media specific parameters include: soil permeability, porosity, organic carbon, moisture, structure, and particle size distribution. DNAPL specific parameters include: vapor pressure, Henry's constant, solubility, adsorption equilibrium, density, and viscosity (20). These parameters and their relationships must be evaluated on a site specific basis when considering the feasibility of vacuum extraction and a practical approach to the design, construction, and operation of venting systems (22). Additionally, soil gas surveys which delineate vapor concentration as a function of depth is critical in locating the contaminant source and designing an SVE system.

Historically, SVE has been used to remove volatile compounds from the soil. Recently it has been observed that SVE enhances the biodegradation of volatile and semivolatile organic compounds in the subsurface. While SVE removes volatile components from the subsurface, it also aids in supplying oxygen to biological degradation processes in the unsaturated zone. Prior to soil venting, it was believed that biodegradation in the unsaturated zone was limited due to inadequate concentrations of oxygen (17). In a field study where soil venting was used to recover jet fuel, it was observed that approximately 15% of the contaminant removal was from the result of microbial degradation. Enhanced aerobic biodegradation during SVE increases the cost effectiveness of the technology due to the reduction in the required above ground treatment.

Vacuum extraction is one form of pump and treat except that the fluid is a gas mixture and that it occurs in the unsaturated zone. Therefore, many of the same limitations to pump and treat are also applicable to vacuum extraction. While the application of vacuum extraction is conceptually simple, its success depends on understanding complex subsurface

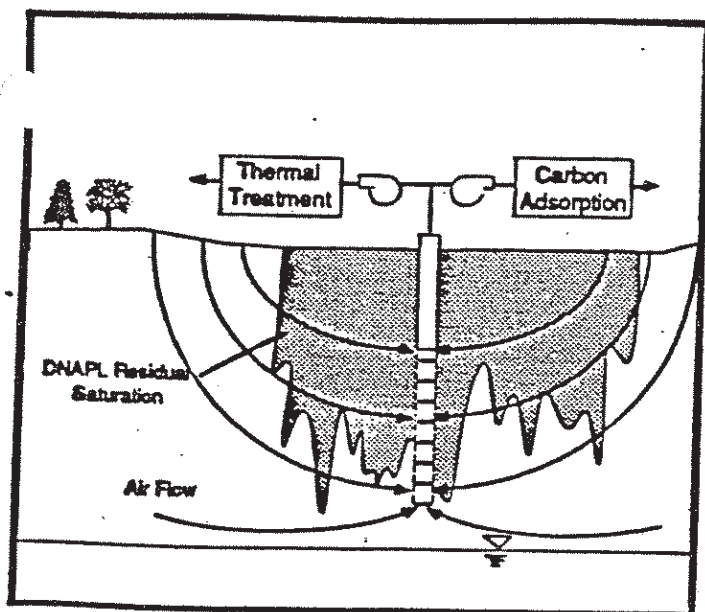


Figure 22. Vacuum extraction of DNAPL volatile components in the unsaturated zone. As shown here, vapors are treated by thermal combustion or carbon adsorption and the air is discharged to the atmosphere.

chemical, physical, and biological processes which provide insight into factors limiting its performance (9).

degradation

The potential for biodegradation of immiscible hydrocarbon is highly limited for several reasons. First, pure phase hydrocarbon liquid is a highly hostile environment to the survival of most microorganisms. Secondly, the basic requirements for microbiological proliferation (nutrients, electron acceptor, pH, moisture, osmotic potential, etc.) is difficult if not impossible to deliver or maintain in the DNAPL. A major limitation to aerobic bioremediation of high concentrations of hydrocarbon is the inability to deliver sufficient oxygen. A feasible remediation approach at sites where immiscible hydrocarbon is present is a phased technology approach. Initial efforts should focus on pure phase hydrocarbon recovery to minimize further migration and to decrease the volume of NAPL requiring remediation. Following NAPL recovery, other technologies could be phased into the remediation effort. Bioremediation may be one such technology that could be utilized to further reduce the mass of contaminants at the site. NAPL recovery preceding bioremediation will improve bioremediation feasibility by reducing the toxicity, time, resources, and labor.

Similar to other remediation technologies, a comprehensive feasibility study evaluating the potential effectiveness of bioremediation is critical and must be evaluated on a site specific basis. A comprehensive review of biodegradation of surface soils, ground water, and subsoils of wood preserving wastes, i.e. PAH's (29,37,51,62,63) are available. A comprehensive review of microbial decomposition of chlorinated aromatic compounds is also available (58).

Soil Flushing

Soil flushing utilizing surfactants is a technology that was developed years ago as a method to enhance oil recovery in the petroleum industry. This technology is new to the hazardous waste arena and available information has mainly been generated from laboratory studies. Surfactant soil flushing can proceed on two distinctly different mechanistic levels: enhanced dissolution of adsorbed and dissolved phase contaminants, and displacement of free-phase nonaqueous contaminants. These two mechanisms may occur simultaneously during soil flushing (42).

Surfactants, alkalis, and polymers are chemicals used to modify the pore-level physical forces responsible for immobilizing DNAPL. In brief, surfactants and alkalis reduce the surface tension between the DNAPL and water which increases the mobility. Polymers are added to increase the viscosity of the flushing fluid to minimize the fingering effects and to maintain hydraulic control and improve flushing efficiency. Based on successful laboratory optimization studies where an alkali-polymer-surfactant mixture was used, field studies were conducted on DNAPL (creosote) which resulted in recovery of 94% of the original DNAPL (42). Laboratory research has also been conducted which indicated that aqueous surfactants resulted in orders of magnitude greater removal efficiency of adsorbed and dissolved phase contaminants than water flushing (55).

Depth to contamination, DNAPL distribution, permeability, heterogeneities, soil/water incompatibility, permeability reduction, and chemical retention are important factors when considering soil flushing (42). Prior to this technology being cost effective in the field, surfactant recycling will be necessary to optimize surfactant use (55). Soil flushing is complex from a physical and chemical point of view; is relatively untested in the field; and will likely be challenged regulatorily. Considerable research currently being conducted in this area may result in the increased use of this technology to improve DNAPL recovery in the future.

Thermal methods of soil flushing involve injecting hot water or steam in an effort to mobilize the NAPL. The elevated temperature increases volatilization and solubilization and decreases viscosity and density. A cold-water cap is used to prevent volatilization. The mobile phases of the DNAPL are then recovered using a secondary approach, i.e. pumping, vacuum extraction etc. This approach (Contained Recovery of Oily Wastes) to enhance recovery of DNAPL is currently under EPA's Superfund Innovative Technology Evaluation Program and a pilot-scale demonstration is forthcoming (21). A limitation in the use of thermal methods is that the DNAPL may be converted to LNAPL due to density changes (36). The adverse effects from this are that the DNAPL, existing as a thin layer, becomes buoyant and mobilizes vertically resulting in a wider dispersal of the contaminant. Other limitations involve the high energy costs associated with the elevated water temperature and the heat loss in the formation (36).

Physical Barriers

Physical barriers may be used to prevent the migration of DNAPL's in the subsurface and are typically used in conjunction with other recovery means. One feature of physical

barriers is the hydraulic control it offers providing the opportunity to focus remediation strategies in treatment cells. Unfortunately, physical barriers, while satisfactory in terms of ground water control and containment of dissolved-phase plumes, may contain small gaps or discontinuities which could permit escape of DNAPL (7). Chemical compatibility between physical barriers and construction material must agree to insure the physical integrity of the barrier. The history of the performance of these containment technologies is poorly documented and is mainly offered here for completeness of review. A more complete review of these physical barriers is available (5,56).

Sheet piling involves driving lengths of steel that connect together into the ground that form an impermeable barrier to lateral migration of DNAPL. Ideally, the bottom of the sheet pile should be partially driven into an impermeable layer to complete the seal. Slurry walls involve construction of a trench which is backfilled with an impermeable slurry (bentonite) mixture. Grouting is a process where an impermeable mixture is either injected into the ground or is pumped into a series of interconnected boreholes which together form an impermeable boundary. Again, the main feature of these techniques is to physically isolate the DNAPL.

In summary, site characterization and remediation options for sites containing DNAPL are limited. Field results from site characterization and remediation efforts are also limited. This is largely due to the complexity of DNAPL transport and fate in the subsurface; poorly developed techniques currently available to observe and predict DNAPL in the subsurface, and due to the fact that this issue has not been widely recognized, until recently. Clearly, there is a growing realization within the scientific and regulatory community that DNAPL is a significant actor in limiting site remediation. Correspondingly, current research efforts within the private industrial, and public sectors are focusing on both the fundamentals and applications aspects of DNAPL behavior in subsurface systems. Additionally, the number of field investigations reflecting an increased awareness of DNAPLs, is growing.

DNAPL Modeling

A modeling overview report identified nineteen (numeric and analytic) multiphase flow models which are currently available (8). Most of these models were developed for salt water intrusion, LNAPL transport, and heat flow. Four models are qualitatively described as immiscible flow models but do not specifically indicate DNAPL. A more recent model has been developed which simulates density driven, three phase flow. It is capable of modeling DNAPL transport (23). Presently, very little information is available on DNAPL modeling in the scientific literature.

Multiphase flow modeling involves modeling systems where more than one continuous fluid phase (LNAPL, water, gaseous) are present. Modeling any subsurface system requires a conceptual understanding of the chemical, physical, and biological processes occurring at the site. Modeling of simultaneous flow of more than one fluid phase requires a conceptual understanding of the fluids and the relationship between the fluid phases. The significance of multiphase flow over single phase flow is the increased complexity of fluid flow and the additional data requirements necessary for modeling.

As presented earlier, numerous variables strongly influence DNAPL transport and fate, and consequently, the mathematical relationship of these variables is complex. Therefore, it follows that DNAPL modeling presents paramount technical challenges.

Presently, it is exceedingly difficult to obtain accurate field data which quantitatively describes DNAPL transport and fate variables within reasonable economic constraints. DNAPL transport is highly sensitive to subsurface heterogeneities (8,27,28) which compounds the complexity of modeling. Heterogeneities are, by nature, difficult to identify and quantify and models are not well equipped to accommodate the influence of heterogeneities. Additionally, relative permeability and capillary pressure functions must be quantified to identify the relationship between fluids and between the fluids and the porous media. Unfortunately, these parameters are very difficult to measure, particularly in three phase systems. Prior to an investment of time and money to model a given site, a careful evaluation of the specific objectives and the confidence of the input and anticipated output data should be performed. This will help illuminate the costs, benefits, and therefore, the relative value of modeling in the Superfund decision making process.

In summary, DNAPL modeling at Superfund sites is presently of limited use. This is mainly due to: the fact that very little information is available in the scientific literature to evaluate previous work; accurate and quantitative input data is expected to be costly; the sensitivity of DNAPL transport to subsurface heterogeneities; and, the difficulty in defining the heterogeneities in the field and reflecting those in a model. However, multiphase flow models are valuable as learning tools.

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ATTACHMENT B
PACKER TEST PROCEDURE

PACKER TEST PROCEDURES

I. Introduction

Packer testing is a method used to estimate the hydraulic conductivity of discrete bedrock zones within an open-bedrock corehole or open-bedrock well/piezometer. A packer test involves tightly sealing off a selected interval in the bedrock hole, pumping clean water into the test interval under a specified head for a specified duration, and recording the volume of water pumped into the formation during the test duration. To allow interpretation of the flow characteristics (e.g., laminar or turbulent), the rock fracture response (e.g., dilation, washout, or void filling) and the representative conductivity value for the tested bedrock interval, five test increments are performed at three different head conditions. The hydraulic conductivity is calculated based on the observed test pumping rates, the total applied head values, the geometry of the tested interval, and the pattern of pumping rates achieved during each of the five test increments.

The following presents methods for both single and double packer testing.

II. Materials

The equipment used for packer testing consists of two assemblies:

- (1) A packer apparatus consisting of inflatable rubber packer(s) and a length of perforated pipe; and
- (2) A water system, including a water meter, pressure gauge and valves to adjust and maintain the water pressure and flow.

The following list of equipment to be used for packer testing is meant to serve only as a guide because actual site and borehole conditions may require modifications. The driller may provide much of the equipment. Typical equipment and materials used to perform packer testing include:

- Drill rig to install and remove the packer and water pipe;
- Packer (pneumatic or hydraulically actuated);
- Water pipe, ranging from 1 to 2 inches in diameter, depending on the permeability and surface area of the test section;
- Flow meter of the same diameter as the water pipe above;
- Pump, capacity to approximately 50 gpm;
- Storage tanks of appropriate volume for holding clean water for injection into test interval;
- Two pressure transducers, sized in accordance with the depth of the test interval and the excess injection pressure to be applied during the test;
- Compressed gas cylinders, regulators, and tubing for inflating pneumatic packers or alternative pressure source if hydraulically-actuated packers are used;
- Water swivel or elbow;
- Hose or piping of the same diameter as the water pipe;
- Electronic data logger for recording transducer output;

- Water level indicator or equivalent oil/water interface meter with 0.01 foot increments;
- Stopwatch;
- Constant-head injection data sheets (an example is provided in Figure 1);
- Personal Protective Equipment (PPE) as required by the Site-specific EHS Plan;
- Decontamination supplies (as needed); and
- Field logbook.

III. Packer Apparatus Configurations

Either single-packer or double-packer configurations may be used to perform the packer test. The single-packer test typically is performed after each core run during the drilling of corehole. The packer is seated at the top of the interval of rock core just removed, and the newly exposed section of bedrock is tested. To remove sediment from the corehole wall, the corehole may be bailed, surged or swabbed prior to packer testing. The test should not be initiated, however, until the water level in the drill casing returns to the static level.

Single-packer tests may provide more reliable results than double-packer tests because if water leaks past a single, upper packer, the leak may be discerned by the recognition of a rising water level in the corehole or drill casing above the packer or by the appearance of water in the casing at the ground surface. In contrast, if a double-packer configuration is used, leakage past the lower packer may enter a permeable corehole section below the lower packer without being recognized as leakage.

The double-packer configuration is used if discrete rock intervals are to be tested in a previously-drilled long open corehole. Two packers are placed in the corehole and inflated with the perforated portion of the pipe between the packers. The spacing between the packers, corresponding to the test interval length, typically is 5 to 0 feet. Specified bedrock intervals are tested starting from the bottom of the hole and working upwards at intervals selected by the supervising geologist/engineer.

IV. Water System

The water system typically is assembled with a bypass valve and line connected to the main water line before the water meter valve. The purposes of the bypass valve are (1) to dampen the surge of water produced by the action of the pump, thus providing a relatively constant flow rate and water pressure; and (2) to allow a pressure bypass so that relatively low pressures may be applied to the tested rock interval, if appropriate. A surge suppression tank may also be plumbed into the water system before the bypass line to help dampen pump surge affects.

A water meter valve and the water meter follow the bypass valve and line. Flow to the tested rock interval passes through the water meter valve and is recorded by the water meter. The bypass and water meter valves are used simultaneously to maintain the water in the line at the desired pressure. The maximum water pressure for a particular pumping rate is achieved with the meter valve fully opened and the bypass valve fully closed. The bypass valve should be used as much as possible, however, to utilize its surge damping effect.

The remainder of the water system apparatus consists of a check valve, a relief valve and line, a water pressure gauge, and finally a length of riser pipe connecting the perforated pipe and packer assembly to the water supply apparatus. The pressure gauge indicates the water pressure in the apparatus at that location, rather than the pressure applied to the tested rock interval. The total head applied during a test consists of the gauge pressure plus the elevation head (the vertical distance between the pressure gauge and the static water level in the corehole), minus the frictional head loss between the pressure gauge and the perforated pipe where the water exits the apparatus and enters the tested rock interval. The magnitude of frictional head loss depends on the length of riser pipe used and the pumping rate, and is best determined empirically by calibrating the test assembly in the field. Alternately, frictional losses may be estimated based on hydraulics equation such as the Hazen-Williams equation (Meritt, 1983), which relates head loss to pipe geometry and flow rate.

V. Packer Test Apparatus Calibration

The frictional head loss in the riser pipe assembly should be determined in the field by a calibration process to obtain a reliable estimate of the total head applied to the test interval. The calibration is performed by pumping water through the apparatus at a constant pressure and flow rate for a specified duration, typically a few minutes. The gauge pressure, total flow volume, pumping duration, and riser pipe length are recorded, and the procedure is repeated at a different flow rate. The process is repeated at several flow rates that span the representative range of flow rates achievable by the pump.

The calibration is performed with the water system and packer apparatus laid out horizontally along the ground surface. The packer(s) remain deflated during the calibration procedure to avoid rupturing. The perforated section of pipe is supported slightly above the ground surface so that water may drain freely during pumping through the test assembly. The perforated pipe section and the pressure gauge are situated at approximately equal elevation during the calibration to eliminate the elevation head between the pressure gauge and the perforated pipe section. Because the elevation head is zero, the pressure gauge measurements obtained during calibration indicate only the frictional head loss in the pipe assembly.

The calibration process should be repeated and a separate set of gauge pressure versus pumping rate data generated for each total length of riser pipe used during actual packer testing. The calibration procedure may be performed after the appropriate riser-pipe lengths are identified by the performance of packer tests. The data of gauge pressure versus pumping rate are later plotted on a X-Y axis. A best-fit power-law regression curve is calculated for each data set to determine the mathematical relationship between pumping rate and frictional loss. During hydraulic conductivity calculation, frictional head loss for each observed flow rate is estimated from the plot of calibration data corresponding to the length of riser pipe used during the test.

VI. Test Gauge Pressure Calculation

Appropriate test pressures to be used during each of the five test increments are calculated as follows:

- (1) Calculate the maximum gauge pressure, to be used during test increment #3 as:

$$P_3 \text{ (psi)} = 0.75 \times \text{Depth of Test Section Midpoint (feet)}$$

- (2) Calculate the gauge pressures to be used during the other test increments as:

$$P_1 = P_5 = 0.4 \times P_3 \text{ and}$$

$$P_2 = P_4 = 0.7 \times P_3.$$

VII. Packer Test Procedures

Prior to testing a given bedrock interval, the corehole identification number, the depth of the test interval, the static depth to water in the corehole, the gauge height above ground surface, and the length of riser pipe used in the apparatus are recorded on a packer test data log. After the packer(s) have been seated at the desired interval, the remainder of the test is performed as follows:

1. Open the bypass valve completely with the water meter valve closed.
2. Start the pump or open other water supply.
3. Open the meter valve slowly to allow water to flow and pressure to build. If this valve is completely opened and additional pressure is still needed, it may be obtained by slowly closing off the bypass valve, thus forcing more water through the water meter valve.
4. After the desired pressure for a desired given test increment has been achieved, record the time and volume from the totalizing water meter.
5. To perform a test increment, record the water meter reading at one minute intervals for 5 to 10 minutes of continuous pumping. Check the gauge to ensure the pressure remains constant throughout the test increment, and adjust the flow valves as needed to maintain constant pressure.
6. Adjust the valves in the water system to achieve the calculated appropriate pressure for the next test increment, and repeat steps #4 and #5 above.
7. If the appropriate test interval gauge pressure cannot be achieved due to a highly-permeable tested bedrock interval, the maximum achieved gauge pressure and the pumping rate data for the five minute test increment should be recorded.
8. The packer test for a given bedrock interval is complete after all five test increments have been performed.
9. Record the test data on the packer test data log.

VIII. Packer Test Data Reduction

Packer test data are reduced to develop estimates of hydraulic conductivity for each tested interval based on standard data reduction procedures (United States Bureau of Reclamation, 1974; Houlby, 1976). Data are entered into an automatic packer-test data reduction spreadsheet program. The spreadsheet calculates the hydraulic conductivity from each of the five test increments for each tested bedrock interval as:

$$K = C_p Q/H$$

where:

K = hydraulic conductivity (feet per year);

Q = flow rate (gallons per minute);

H = total head applied during test (feet); and

C_p = packer coefficient.

Based on equations published in the Earth Manual (United States Bureau of Reclamation 1974), the packer coefficient can be calculated from:

$$C_p = [70267 \ln (L/r)] / 2\pi L$$

where:

L = length of the tested bedrock interval (feet); and

r = radius of tested bedrock corehole (feet).

In addition to the hydraulic conductivity value, the packer test reduction spreadsheet calculates a Lugeon value (Houlby, 1976) for each of the five test increments. The five Lugeon values are evaluated to interpret the type of flow and bedrock formation response and most representative calculated hydraulic conductivity value for the tested bedrock interval from the following list:

(1) Laminar Flow

Indication: Lugeon values are approximately equal.

Conductivity: Average of values from five test increments.

(2) Turbulent Flow

Indication: Lugeon value from increment #3 is less than those from the lower pressure increments, which are approximately equal in value.

Conductivity: Value from increment #3.

(3) Dilation of Bedrock Fractures

Indication: Lugeon value from increment #3 is greater than those from the lower pressure increments which are approximately equal in value.

Conductivity: Average value from increments #1 and #5.

(4) Wash-out of Fracture Filling Materials

Indication: Progressive increase in five Lugeon values without any return to lower values during increments #4 and #5.

Conductivity: Value from increment #1.

(5) Void Filling

Indication: Progressive decrease in five Ludgeon values without any return to values during increments #4 and #5.

Conductivity: Value from increment #5.

REFERENCES

Houlsby, A.C., 1976, Routine Interpretation of the Lugeon Water-Test, Q. Jl. Engng. Geol. Vol. 9, pp. 303-313.

Meritt, F.S., 1983, Standard Handbook for Civil Engineers, McGraw-Hill, New York.

United States Bureau of Reclamation, 1974, Earth Manual, 2nd Edition, Department of the Interior, Denver, Colorado, pp. 573-578.

FIGURE 1

TYPICAL CONSTANT-HEAD INJECTION TEST DATA SHEET

[illegible]

**GENERIC
SITE CHARACTERIZATION/IRM WORK PLAN
FOR
SITE INVESTIGATIONS
AT NON-OWNED FORMER MGP SITES**

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LIST OF ABBREVIATIONS AND ACRONYMS

ASP	Analytical Service Protocol
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	Benzene, toluene, ethylbenzene and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DOT	Department of Transportation
DQOs	Data Quality Objectives
DUSR	Data Usability Summary Report
EHS	Environmental Health and Safety
FOL	Field Operations Leader
FSP	Field Sampling Plan
FWIA	Fish and Wildlife Impact Analysis
IDW	Investigation Derived Waste
IRM	Interim Remedial Measure
LNAPL	Light Non-Aqueous Phase Liquid
MGP	Manufactured Gas Plant
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSDS	Material Safety Data Sheets
NAPL	Non-aqueous phase liquid
NCP	National Contingency Plan
NM	Niagara Mohawk
NMFS	National Marine Fisheries Service
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSECL	New York State Environmental Conservation Law
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SHPO	State Historic Preservation Office
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
UFPO	Underground Facilities Protective Organization
USCS	United Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCO	Voluntary Consent Order
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This document, herein referred to as the Work Plan ("the Generic SC/IRM Work Plan") for the Niagara Mohawk, a National Grid Company, (NM) Non-owned Former Manufactured Gas Plant (MGP) Sites, was prepared by Foster Wheeler Environmental Corporation on behalf of NM. Preparation of this Generic SC/IRM Work Plan has been conducted in response to and in accordance with the requirements of the Voluntary Consent Order (VCO) between the New York State Department of Environmental Conservation (NYSDEC) and NM (Index D0-0001-0011) dated July 3, 2001. Implementation of the Generic Work Plan will meet the spirit and intent of the New York State Environmental Conservation Law (NYSECL), the VCO, NYSDEC requirements, protocols and guidance, as well as applicable Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Contingency Plan (NCP) and United States Environmental Protection Agency (USEPA) guidelines, as appropriate.

The Site Characterizations conducted at each Non-owned Former MGP Site will consist of an initial Site Characterization (SC) and, if required, a Remedial Investigation (RI). If MGP-impacted media is encountered during the SC and it is determined that further investigation and/or remediation is needed to allow a particular site to be used for the contemplated use, a RI work plan will be prepared and submitted. The SC may consist of a soil and groundwater investigation; test pit excavations and a baseline ground survey. The Fish and Wildlife Resource Impact Analysis (FWRIA), and a Phase 1A Cultural Resource Survey will be completed during the RI. The detailed scope of work for the Site Characterization at each Site is presented in the respective Site-Specific SC/IRM Work Plan. In developing the Site-Specific Work Plan, NM's Engineering Consultant will review the specific and unique Site conditions and evaluate the specific objectives of the Site Characterization. Modifications to this Generic Plan as determined appropriate and necessary by the Engineering Consultant, are to be included in the Site-Specific Work Plan. To the extent discrepancies exist between this Generic SC/IRM Work Plan and the Site-Specific SC/IRM Work Plan, the Site-Specific SC/IRM Work Plan shall control. Following implementation of Site Characterization field activities, an evaluation regarding the necessity for implementation of an Interim Remedial Measure (IRM) to address MGP impacts, if any, will be performed at each Site.

1.1 Non-owned Former MGP Site Locations

This Generic SC/IRM Work Plan covers the implementation of standard tasks to be conducted at each of the Non-owned Former MGP Sites. Site-Specific information, including a Site description and history for each of the Non-owned Former MGP Sites is presented in the respective Site-Specific SC/IRM Work Plans.

1.2 Objective of the Site Characterization

The following are the specific objectives for each Site Characterization/IRM:

- Evaluate whether MGP-impacted soil or groundwater are present at the Site;
- Determine the potential presence of MGP-related non-aqueous phase liquid (NAPL) in on-site soil and groundwater;
- Evaluate, to the extent practicable, whether groundwater flow may be a pathway for off-site migration of MGP constituents (if present);
- Provide sufficient data to evaluate necessary interim remedial measures.

1.3 Work Plan Organization

Section 1 of this Generic Work Plan is the Introduction, providing information on the scope of work, and objectives of the Site Characterization/IRM. Section 2 is the Work Plan Rationale, which includes the specific data requirements in order to meet project objectives. This section also discusses the Data Quality Objectives for the project. Section 3 is the scope of work for the Site Characterization/IRM and the Site Characterization/IRM Report to be prepared upon completion of the field activities. Section 4 is the schedule of the Site Characterization/IRM for each of the sites. Section 5.0 lists the references used in preparation of the report.

This Generic Work SC/IRM Plan is presented as Appendix A (Volume II) to the Site-Specific Work Plan for each Site subject to the VCO. Appendix B is the Generic Field Sampling Plan (Generic FSP) that describes the field procedures to be employed during the project. Appendix C is the Environmental Health and Safety (EHS) Plan for the Sites. (Site-specific information such as an emergency contact list, route to the hospital, etc. for each Site is contained in the respective Site-Specific SC/IRM Work Plan.) Appendix D is the Generic Quality Assurance Project Plan (Generic QAPP), which provides information on the quality assurance/quality control (QA/QC) measures to be followed during all Site Characterization efforts. Site-Specific QA/QC measures (e.g. number of QC samples to be collected) are presented in the Site-Specific SC/IRM Work Plan for each Site.

2.0 WORK PLAN RATIONALE

2.1 Approach/Basis for Data Collection

This section of the Generic Work Plan provides the basis for the field activities.

- **Evaluate whether potential sources of MGP-Impacted soil or groundwater are present at the Site;**

During preparation of the Generic Work Plan, the Engineering Consultant should review historical information (i.e. Sanborn Fire Insurance maps, abstracts-of-title, and deed etc.) as well as perform a complete records search including: MacRae's Industrial Directory, Site Plans and as-built (if any), and Department Geographic Information Systems. Additionally, the Engineering Consultant should visit the Federal, State and local government offices to evaluate adjacent property information, evaluate the possible presence of storage tanks and locate any aerial photographic surveys. The completion of the historical review will result in the identification of structures associated with the former MGP operations. A component of Site Characterization field activities will be the excavation of test pits through the subgrade former holder walls or in the vicinity of former purifier(s), or both. The test pits, if proposed in the site-specific SC/IRM work plan, will be visually examined to aid with the evaluation of the location, dimensions, and construction of the former structures and whether impacts to surrounding media are evident.

- **Determine the potential presence of MGP-related non-aqueous phase liquid (NAPL) in on-site soil and groundwater;**

Soil borings will be located on-site in a modified grid pattern to identify locations representing potential sources of MGP-impacted groundwater, if any. The grid will be modified; however, so that soil in the vicinity of former MGP structures is characterized. Monitoring wells will be installed in some of the boring locations for the collection of groundwater samples for testing and for the collection of water level measurements to ascertain groundwater flow direction. A component of field activities will include the collection of groundwater samples for chemical analysis. The data generated will be the basis for evaluating whether former structures at the Site (e.g. gas holders, purifiers) contain residuals that are impacting local groundwater. Laboratory analyses were selected based on suspected chemical constituents.

The Engineering Consultant will also collect surface soil samples at Sites that are not currently (or formerly) covered with asphalt, from a depth interval of 0 to 2 inches below ground surface (bgs). The surface soil samples will determine if constituents (PAHs) that may have been associated with former Site operations are present in on-site surface soils. Samples will also be collected at off-site locations so that background conditions may be established. These background locations must be representative of the present/former use conditions at the site. The Engineering Consultant, in consultation with NM, NYSDEC and NYSDOH, will select locations for background samples.

- **Evaluate, to the extent practicable, whether groundwater flow may be a pathway for off-site migration of MGP constituents (if present);**

Based on the location of former MGP structures as identified above, locations of groundwater wells were placed in the most logical locations utilizing information collected prior to the start of field work, to provide upgradient and downgradient data, using an assumed direction of groundwater flow. Monitoring wells will be installed, gauged, and sampled in order to verify the direc-

tion of groundwater flow and to characterize constituents in groundwater. These data will be used to assess whether groundwater flow may be a pathway for the off-site migration of chemical constituents.

- **Provide sufficient data to evaluate necessary interim or long-term remedial measures.**

The Engineering Consultant will evaluate, based on data and visual observations at each Site, whether IRMs are necessary. At the discretion of NM, and in consultation with the NYSDEC and New York State Department of Health (NYSDOH), an IRM may be initiated while Site Characterization field activities are on going.

2.2 Data Quality Objectives

The Generic FSP (Appendix B) outlines the procedures to be implemented for collection of the data. The Generic QAPP (Appendix D) specifies the appropriate analytical methodologies to be utilized for the testing of the various media and the data quality necessary to meet the objectives of the Site Characterization.

3.0 SITE CHARACTERIZATION FIELD ACTIVITIES

This section provides an overview of the field activities to be performed as part of the Site Characterization at each of the Non-owned Former MGP Sites. Further details associated with the field activities are provided in the Generic FSP (see Appendix B), the Generic HSP (see Appendix C), and the Generic QAPP (see Appendix D).

3.1 Site Reconnaissance

The purpose of the Site reconnaissance task is to verify and mark proposed sampling locations, waste storage locations, and the location for placement of the temporary decontamination pad. In addition, the Site owner or company representative will be asked to identify the location of known subsurface utilities and/or structures on the Site. Site reconnaissance activities will be attended by the NM Project Manager, Engineering Consultant's Project Manager or Field Operations Leader (FOL), and a representative from the NYSDEC and/or NYSDOH. The Site meeting will be scheduled within (10) ten days of NM establishing an access agreement with the owner or tenant of the Site, as appropriate (assuming prior approval of the Site-Specific Work Plan by NYSDEC).

3.2 Site Characterization Field Sampling Activities

Following the Site reconnaissance task, the Engineering Consultant will mobilize the necessary equipment, manpower, and materials to the Site. Notification of NYSDEC and NYSDOH will be provided (10) ten days prior to mobilization to the Site. The drilling subcontractor will set-up a temporary decontamination pad and decontaminate all subsurface sampling and downhole equipment in accordance with the Generic FSP (see Appendix B).

3.2.1 Mobilization/Utility Markout

The Engineering Consultant will coordinate with the Underground Facilities Protective Organization (UFPO), and the property owner or company representative of the Site to schedule the meeting. The Engineering Consultant, through UFPO, will contact local utility companies (i.e., telephone, gas, electric, cable, water, sewer, etc.) at least 72 hours prior to mobilization. NM will request that the property owner/company representative locate all other known on-site utilities/subsurface structures prior to mobilization. (See Appendix B, Generic FSP for details).

Following completion of these activities, the Engineering Consultant will mobilize to the Site to review the utility markouts, in relation to the approved Site-Specific Work Plan sampling locations and initiate field activities.

Proposed soil boring, monitoring well, and test pit excavation locations will be evaluated with respect to nearby (i.e. within 20 ft) overhead obstructions. The locations will also be evaluated with respect to on-site and off-site utility markouts and available engineering drawings of the Site. After proposed sampling locations have been modified, if necessary, the sampling locations will be finalized by the placement of markings on the ground surface with paint or painted stakes.

A decontamination pad will be constructed in an area approved by NM and the property owner. An area will also be established for the storage of drummed cuttings and fluids generated during the Site Characterization and for equipment and materials.

3.2.2 Surface Soil Sampling

Surface soil samples will be collected on-site to assess the near surface conditions and to determine if shallow soils have been impacted by the chemical constituents. The sample locations have been selected based on a modified grid pattern. The sampling locations will be finalized during the Site reconnaissance task. Visual evidence of near surface MGP related impacts and/or stressed vegetation, related to former MGP structures, will assist in final determination of the sample location orientation. The surface soil sampling locations are presented in the appropriate Site-Specific Work Plan (Volume I).

Surface soil samples will be collected with a stainless steel spoon from the interval 0 to 2 inches below the surface ground cover (e.g. gravel), if present. Surface soils will be screened with a PID and through visual and olfactory observation prior to collection. If surface soil samples do not contain observable impacts then the VOC analysis will not be performed, if observable impacts are identified then the soil sample will be analyzed for volatile organic compounds (VOCs) on the Target Compound List (TCL). All Samples, at a minimum, will be analyzed for semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) metals, and total organic carbon (TOC). Additional details on the sampling procedure are provided in the Generic FSP (see Appendix B) and the Generic QAPP (see Appendix D).

3.2.3 Soil Boring Installation

Soil borings will be drilled for the purpose of obtaining subsurface soil samples for analytical testing, geological characterization, and for the installation of monitoring wells. Boring locations were established according to a modified grid, biased toward areas where former MGP structures were located. Soil boring locations at each Site are presented in the respective Site-Specific Work Plan. The top 5 feet at each soil boring location will be hand-dug if subsurface live utilities are suspected to be present. If subsurface live utilities are found near a boring location then the location will be reoriented and the live subsurface utility will be properly protected.

Soil borings will be advanced through the unconsolidated deposits to the top of the bedrock surface, to the first confining layer, or to a pre-determined depth (either 20 or 30 feet, as specified in the Site-Specific Work Plan) whichever is encountered first. If at this depth MGP impacts are encountered, the soil borings will be advanced deeper until there is reasonable assurance we are beyond the impact zone. Drilling methods are presented in the Generic FSP (see Appendix B).

Following the completion of the soil borings and sampling, the boreholes will be abandoned with a cement-bentonite grout or utilized for the installation monitoring wells. All soil cuttings generated during the drilling process will be stored in Department of Transportation (DOT) approved 55-gallon steel drums or roll-offs and moved to an on-site location approved by NM and the property owner. Disposal of these soils will be in accordance with applicable regulations and NYSDEC guidance.

3.2.4 Subsurface Soil Sampling

Split-spoon samples will be collected continuously from each soil boring. Split-spoon samples will be screened with field instruments and using odor and visual characteristics for residues or staining. The results will be noted in the field logbook. In addition, soil samples will be logged in accordance with ASTM D2487 (engineering purposes)/D2488 (desorption) or the Burmeister method and classified with respect to the United Soil Classification System (USCS). All soil classification data, instrument readings, and other observations will be documented in the field log-

book. Details are provided in the Generic FSP (see Appendix B) and the Generic QAPP (see Appendix D).

Soil samples will be collected at predetermined depth intervals (see Site-Specific Work Plan) from each boring and sent to the laboratory for chemical testing. Soil samples will be analyzed for benzene, toluene, ethylbenzene and xylene (BTEX); polycyclic aromatic hydrocarbons (PAHs); and total cyanide. In addition, one sample will be collected from each boring and submitted for TOC analysis and (10%) ten percent of all subsurface soils will be analyzed for TCL/TAL parameters. Certain soil samples will also be analyzed for polychlorinated biphenyls (PCBs) where historical electrical equipment was suspected to have been located. Additional details are provided in the Generic FSP (see Appendix B), and the Generic QAPP (see Appendix D).

3.2.5 Test Pit Excavations

Test pits will be excavated in former MGP structures or across subgrade holder walls with a backhoe or mini-excavator. Surface cover (e.g. gravel) will be stockpiled on plastic for use following completion of the excavation. Excavated soil will be placed on plastic on the ground surface. Test pits will be advanced to a maximum depth of 12-ft bgs, to the top of the bedrock surface, or to the water table, whichever is encountered first. Each location will be logged and the information recorded in the field logbook.

If prescribed in the Site-Specific Work Plan, soil samples may be collected from an impacted interval. The sampling interval will be selected based on field screening techniques. The soil samples will be analyzed for BTEX, PAHs, and Total Cyanide. Additional details regarding test pit excavation are presented in the Generic FSP (see Appendix B).

3.2.6 Monitoring Well Installation

Monitoring wells will be installed at each Site. Groundwater data collected from the wells will be evaluated with respect to up- and downgradient water quality at the Site, groundwater flow direction, and impact to groundwater, if any. Monitoring well locations at each Site are presented in the respective Site-Specific Work Plan.

The procedures for drilling and sampling at each monitoring well location are described in Sections 3.2.3 and 3.2.4. Details of these procedures are provided in the Generic FSP (see Appendix B). Following the advancement of the borehole to a target depth of 30-ft. bgs, a monitoring well will be installed straddling the water table. If the top of the bedrock surface is encountered prior to encountering the water table, a monitoring well will not be installed. The well construction will consist of 2-inch diameter Schedule 40, slot screen surrounded by an appropriate size sand pack with a bentonite pellet layer on top. The PVC riser will consist of flush joint connections surrounded by a cement-bentonite grout. The screen length and slot size will be selected in the field based on aquifer thickness and geology. The well will be completed with a flushmount roadbox or stickup protective pipe surrounded by a concrete collar at the surface. The well will also have a locking well cap. Monitoring wells will be developed no sooner than 24 hours after installation is complete. The wells will be developed by the surge and evacuate method in accordance with New York State TAGM-HWR-88-4008 (NYSDEC, 1988). Further details on well construction, installation and development are provided in the Generic FSP (see Appendix B) and the Generic QAPP (see Appendix D).

3.2.7 Groundwater Sampling

Two rounds of groundwater samples will be collected from monitoring wells installed during Site Investigation. Methodologies for monitoring well development and groundwater sampling are described in the Generic FSP (see Appendix B).

3.2.8 Groundwater Level Measurements

As a component of groundwater sampling, water level measurements will be collected from each well with an oil/water interface probe. The presence of light non-aqueous phase liquid (LNAPL) and/or a dense non-aqueous phase liquid (DNAPL), if any, will be noted in the field logbook along with a water level measurement. If LNAPL or DNAPL is encountered, a sample may be collected for analysis. Methodology for groundwater level monitoring is presented in the Generic FSP (see Appendix B).

3.2.9 Analytical Program

Laboratory analyses will be conducted in accordance with NYSDEC Analytical Service Protocol (ASP) protocols. Modification and/or use of other testing protocols will be considered, if ASP protocols are not available/applicable. Laboratory analyses will be performed by a NYSDOH approved laboratory.

The individual analyses for each medium to be sampled are discussed above and in the Generic FSP (see Appendix B). Details of the analytical program, including methodologies, containers, and holding times are discussed in the Generic QAPP (see Appendix D).

Data Quality Objectives

The results of the Site Characterization will undergo a detailed review by NYSDEC as well as NM. To support this review, laboratory analyses will be conducted in accordance with NYSDEC ASP protocols and Category B deliverables in accordance with the Data Quality Objectives (DQOs) outlined in the Generic QAPP (see Appendix D). As part of the ASP analyses, the laboratory will generate analytical packages for the Engineering Consultant.

Quality Assurance/Quality Control (QA/QC)

Quality assurance measures for maintaining the quality of laboratory samples collected during field sampling are described in the Generic FSP (Appendix B) and the Generic QAPP (Appendix D).

The analytical data generated from the field activities will be validated in accordance with NYSDEC and USEPA guidance. Data Usability Summary Report (DUSR) will be prepared following completion of the data validation task. Details regarding the data validation are provided in the Generic QAPP (Appendix D).

3.2.10 Waste Management

Investigation derived wastes (IDW) will be generated during implementation of the Site Characterization investigation. These will include soil cuttings, purge water, decontamination fluids, plastic, asphalt/concrete, and personal protective equipment (PPE). These wastes will be containerized and properly labeled in DOT approved 55-gallon steel drums, roll-off containers and/or polypropylene agricultural tanks. The drums will be properly stored at a designated on-site area identified by NM and the property owner. NM will properly dispose of these IDW. Further details are provided in the Generic FSP (Appendix B).

3.3 Baseline Ground Survey

Following the completion of the field activities, the Engineering Consultant will coordinate surveying activities with a surveying subcontractor. All Sampling locations will be surveyed and placed on a Site base map prepared by the surveying subcontractor. Survey data will be provided to the Engineering Consultant within three weeks of the completion of the Site Characterization field activities. Additional discussion of the survey is provided in the Generic FSP (see Appendix B).

3.4 IRM Evaluation

The Engineering Consultant will evaluate whether, based on the current conditions at the Site, an IRM is necessary. An evaluation of IRM alternatives will be performed if an imminent threat to human health and/or to the environment exists based on the data generated in the Site Characterization. An IRM may also be performed at the desecration of Niagara Mohawk if localized MGP-related LNAPL or DNAPL is encountered during field activities and if it appears that removal of such material may facilitate natural attenuation of residual soil and groundwater, reduce the overall project schedule, or reduce the extent of field activities ultimately necessary at the Site.

3.5 Draft Site Characterization/IRM Report

The results of the SC/IRM report will first be submitted to the NYSDEC in a data report format. If it is determined that no MGP-impacted media is present and further investigation and/or remediation is not, a draft Site Characterization/IRM Report (Report) will be prepared and submitted to the NYSDEC. If additional investigation is required, a RI work plan will be submitted to NYSDEC. As the onsite effort for the SC investigation is substantial, the primary focus of any additional investigation would be offsite. The RI work plan will consist of a scope of work and will incorporate the generic QAPP, FSP and EHS Plans.

If a SC/IRM report will be submitted, it will contain the following:

- Site Conditions;
- Site History;
- A detailed and comprehensive description of all tasks completed;
- Results of the Site Characterization field activities, analytical testing program and IRM evaluation;
- Conclusions;
- Recommendations for No Further Action at the Site, additional investigation (if necessary) or any recommended Interim Remedial Measure IRM efforts; and
- Certification that the Site Characterization was performed in accordance with this NYSDEC-approved Site-Specific Work Plan.

Figure 3-1 presents a preliminary table of contents for the draft Report.

Figure 3-1

**Draft Site Characterization/IRM Report
Example Table Of Contents**

- 1.0 EXECUTIVE SUMMARY
 - 1.1 Site Background
 - 1.2 Site Assessment
 - 1.2.1 Project Objectives
 - 1.2.2 Soil Investigation Results
 - 1.2.3 Groundwater Investigation Results
 - 1.2.4 Sediment/Surface Water Investigation Results
 - 1.3 Interim Remedial Measure Evaluation
 - 1.4 Recommendations
- 2.0 INTRODUCTION
 - 2.1 Purpose and Project Objectives of Site Investigation
 - 2.2 Site Location and Description
 - 2.3 Site History
 - 2.3.1 Records Identified and Located
 - 2.4 Background
 - 2.5 Regional Setting
 - 2.5.1 Regional Geology
 - 2.5.2 Regional Hydrogeology
 - 2.5.3 Groundwater Usage In Site Vicinity
 - 2.5.4 Soils
 - 2.6 Site Characterization/IRM Report Organization
- 3.0 SCOPE OF WORK
 - 3.1 Introduction
 - 3.2 Field Investigation
 - 3.2.1 Field Mobilization
 - 3.2.2 Surface Soil Sampling/Analysis
 - 3.2.3 Soil Boring Drilling and Sampling/Analysis
 - 3.2.4 Monitoring Well Installation and Development
 - 3.2.5 Test Pit Excavations and Sampling/Analysis
 - 3.2.6 Surface Water/Sediment Sampling/Analysis
 - 3.2.7 Groundwater Sampling/Analysis
 - 3.2.8 Groundwater Level Measurements
 - 3.2.9 Visual Inspection of Structures
 - 3.2.10 Surveying
 - 3.2.11 Waste Management

Figure 3-1 (Cont'd)

**Draft Site Investigation/IRM Report
Example Table Of Contents**

4.0 SITE CHARACTERIZATION RESULTS

- 4.1 Site Topography
- 4.2 Site Investigation
 - 4.2.1 Surface Water
 - 4.2.2 Geology
 - 4.2.3 Groundwater Hydrogeology
- 4.3 Site Conceptual Model

6.0 CONCLUSIONS AND RECOMMENDATIONS

- 6.1 Conclusions
- 6.2 Recommendations

APPENDICES

- A Soil Boring Logs
- B Monitoring Well Construction Details
- C Test Pit Excavation Logs
- D Surveying Data
- E Analytical Data

4.0 SCHEDULE

The schedule for implementation of each of the Site Characterization at the Non-owned Former MGP Sites is presented in the Site-Specific Work Plans. The field activities will commence following execution of any required property access agreements and procurement of an environmental/engineering consultant to implement the Site-Specific Work Plan.

5.0 REFERENCES

NYSDEC, 1988. Technical and Administrative Guidance Memorandum #4008 – Phase II Investigation Oversight Guidance New York State Department of Environmental Conservation, May 9, 1988.

APPENDIX J

RESPONSIBILITIES OF OWNER AND REMEDIAL PARTY

APPENDIX J

RESPONSIBILITIES OF SITE OWNER, REMEDIAL PARTY AND OFF-SITE OWNER

Responsibilities

The responsibilities for implementing the Site Management Plan (“SMP”) for the Patchogue Former MGP Site (the “Site”), Site #1-52-182, 234 West Main Street Property (the “Off-Site Property”) are divided between the Site owner(s) and a Remedial Party (also known as the Respondent), as defined below. A Matrix of Responsibilities that summarizes the responsibilities of the Respondent and the Off-Site Property Owner is provided as Table 9. The owner(s) is/are currently listed as: (the “owner”).

Site: KeySpan Gas East Corporation d/b/a National Grid, 175 East Old Country Road, Hicksville, New York 11801

Off-Site Property: 210 West Main Realty Corp., 50 Gilpin Avenue, Hauppauge, New York 11788

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party (“RP”), also referenced herein as the Respondent, currently refers to National Grid. The RP (Respondent) is:

National Grid Contact:

Michael Quinlan
175 East Old Country Road
Hicksville, New York 11801
(516) 545-2568

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the Site.

Site Owner's Responsibilities:

The Site owner is currently National Grid. National Grid maintains the following responsibilities. In a future scenario in which National Grid sells the property and is no longer the Site owner, the future Site owner will be responsible for the following:

- 1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the Site.
- 2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that Institutional Controls set forth in an Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the National Grid, upon the National Grid's request, in order to allow the RP to include the certification in the Site's PRR certification to the NYSDEC.
- 3) In the event the Site is delisted, the owner remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.
- 4) The owner shall grant access to the Site to the National Grid and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.
- 5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the Site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3 - Notifications.
- 6) In the event some action or inaction by the owner adversely impacts the Site, the owner must notify the National Grid and the NYSDEC in accordance with the time frame indicated in 1.3 - Notifications and (ii) coordinate the performance of necessary corrective actions with the National Grid.
- 7) The owner must notify the National Grid and the NYSDEC of any change in ownership of the Site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Site property. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes

and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 1.3 of the SMP. A 60-Day Advance Notification Form and Instructions are found at <http://www.dec.ny.gov/chemical/76250.html>.

Off-Site Property Owner's Responsibilities:

- 1) The owner of the Off-Site Property will be responsible to notify the RP/Respondent within the established time frames documented in this SMP of plans for the performance of invasive activities in areas of the Off-Site Property that may encounter known or potential contaminated soils and/or groundwater.
- 2) The owner of the Off-Site Property shall grant access to the Off-Site Property to the National Grid and its agents for the purposes of performing activities required under the SMP, including groundwater monitoring activities, and assuring compliance with the SMP.
- 2) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify National Grid in accordance with the timeframes indicated in Section 1.3.1 - Notifications.
- 3) In the event some action or inaction by the owner adversely impacts the Off-Site Property, the owner must notify the National Grid in accordance with the time frames indicated in Section 1.3.1 - Notifications and (ii) coordinate the performance of necessary corrective actions with National Grid.
- 4) The owner must notify National Grid of any change in ownership of the Off-Site Property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Off-Site Property.

Remedial Party Responsibilities

- 1) The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the Site.
- 2) The National Grid shall report to the NYSDEC activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.
- 3) Before accessing the Site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. National Grid shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the Site visit and/or any final report produced.
- 4) If the NYSDEC determines that an update of the SMP is necessary, National Grid shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the National Grid shall submit a copy of the approved SMP to the owner(s).
- 5) The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). National Grid shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at <http://www.dec.ny.gov/chemical/76250.html>.
- 6) National Grid shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3- Notifications of the SMP.
- 7) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, National Grid shall submit to the NYSDEC for approval an amended SMP.
- 8) Any change in use, change in ownership, change in Site classification (e.g., delisting),

reduction or expansion of remediation, and other significant changes related to the Site may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. National Grid shall contact the NYSDEC to discuss the need to update such documents.

Change in RP ownership and/or control and/or Site ownership does not affect National Grid's obligations with respect to the Site unless a legally binding document executed by the NYSDEC releases National Grid of its obligations.

Future Off-Site Property owners and National Grid and their successors and assigns are required to carry out the activities set forth above.