Albany (Grand Street) Non-Owned Former MGP Site

ALBANY, NEW YORK

Site Management Plan

NYSDEC Site Number: V00466-4

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SITE MANAGEMENT PLAN

1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 INTRODUCTION

This Site Management Plan (SMP) is required as an element of the remedial program for the Trinity Substation parcel located at the Albany (Grand Street) non-owned former manufactured gas plant (MGP) site (hereinafter referred to as the "site") under the New York State (NYS) Voluntary Cleanup Program (VCP) administered by New York State Department of Environmental Conservation (NYSDEC). This SMP has been prepared in accordance with the requirements of a multi-site Voluntary Consent Order (VCO Index # D0-0001-011, Site # V00466-4) between National Grid and the NYSDEC and the NYSDEC-approved *Site Characterization Report/Remedial Action Work Plan* (SC Report/RAWP) prepared by ARCADIS (April 2010).

1.1.1 General

As part of the multi-site VCO between National Grid and the NYSDEC, National Grid was required to investigate and remediate the site located in the City of Albany, Albany County, New York. A Site Location Map is presented as Figure 1. The site area subject to this SMP is shown on the Site Layout presented as Figure 2.

As discussed in the SC Report/RAWP, remedial activities were not required to address the minor MGP-related and non-MGP-related impacts identified at the site. However, some MGP-related and non-MGP-related residuals (including impacted subsurface soil and groundwater) remain in subsurface media at Trinity Substation parcel at the site. This Site Management Plan (SMP) was prepared to manage remaining MGP-related and non-MGP-related residual within the Trinity Substation until a deed restriction (Appendix A) is no longer required in accordance with ECL Article 71, Title 36. All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

This SMP was prepared by ARCADIS of New York, Inc. (ARCADIS), on behalf of National Grid, in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated December 2002 and revised in November 2009, and the guidelines provided by NYSDEC. This SMP addresses the means for implementing Institutional Controls/Engineering Controls (ICs/ECs) that are required by the deed restriction for the site.

1.1.2 Purpose

MGP-related and non-MGP-related residuals remain in subsurface media at the site. ECs have been incorporated into the site remedy to control exposure to remaining contamination during the use of the site to ensure protection of public health and the environment. A deed restriction recorded with the Albany County Clerk will require compliance with this SMP and all ECs and ICs placed on the site. The ICs place restrictions on site use, and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs at the site. This SMP specifies the methods necessary ensure compliance with all ECs and ICs required by the deed restriction for remaining MGP-related and non-MGP-related impacts at the site. This plan has been approved by the NYSDEC, and compliance with this plan is required by National Grid and National Grid's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

This SMP provides a detailed description of all procedures required to manage remaining impacts at the site after completion of the Remedial Action, including: (1) implementation and management of all Engineering and Institutional Controls; (2) media monitoring; (3) performance of periodic inspections, certification of results, and submittal of Annual Review Reports; and (4) defining criteria for termination of site monitoring.

To address these needs, this SMP includes three plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) an Operation and Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems (if required).

This plan also includes a description of Annual Review Reports for the periodic submittal of data, information, recommendations, and certifications to NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the deed restriction. Failure to properly implement the SMP is a violation of the deed restriction, which is grounds for revocation of the Certificate of Completion (COC);

- Failure to comply with this SMP is also a violation of Environmental Conservation Law, Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York (6 NYCRR) Part 375 and the VCO (Index # D0-0001-011, Site # V00466-4) for the site.

1.1.3 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. 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.

1.2 SITE BACKGROUND

1.2.1 Site Location and Description

The Albany (Grand Street) non-owned former MGP site is situated on several parcels in Albany, New York (shown on the Site Layout map presented as Figure 2). The largest portion of the site (identified as the "Grand Street parcel") consists of separate properties identified as 127 Arch Street, 95 Trinity Place, and the Trinity Substation on Figure 2. The Grand Street parcel is located along the south side of Grand Street and is currently occupied by vacant industrial buildings and the National Grid Trinity Substation. The remaining parcels (identified as 17 Park Avenue, 30 Park Avenue, and 15 Warren Street on Figure 2) are located to the north and south of Park Avenue, approximately 500 feet west of the Grand Street parcel.

The Grand Street parcel is bordered by Grand Street to the west, residential buildings and a multistory apartment building (the Schuyler Apartments, which was previously a school) to the north, Trinity Place to the east, and Arch Street to the south. The National Grid Trinity Substation occupies the northern portion of the Grand Street parcel and vacant multistory industrial buildings (the former F. Jacobson & Sons Shirt Factory) occupy the southern portion of the parcel. One of the vacant buildings along Grand Street (95 Trinity Place as shown on Figure 2) was recently purchased by the Capital City Rescue Mission and the building is being renovated to include 44 temporary residence/itinerant apartments. The Trinity Substation is surrounded by an approximately 10-foot-high concrete wall. Access to the substation is restricted by locked gates located in the southwest (along Grand Street) and northeast (along Trinity Place) corners of the substation. Access to the southern portion of the parcel (the industrial buildings) is limited, with the exception of one driveway located along Arch Street which services a loading dock on the north side of the building.

1.2.2 Site History

This section discusses the historical use of the site with emphasis on the former MGP operations. The historical information presented below is based on review of Sanborn Fire Insurance Maps (for the years 1892, 1909, 1934, 1950, 1989, 1990, 1993 and 1995) and information contained in the document entitled "Survey of Town Gas and By-Product Production and Locations in the U.S. (1880-1950)" prepared by the United States Environmental Protection Agency (USEPA, 1985). Additional historical information relating to the site was obtained from the Albany Public Library and the Albany Institute of History & Art, including information relating to the history of gas lighting and the development of energy utilities in the City of Albany. Information regarding historical site operations was also identified based on review of a map entitled "New Topographic Atlas of the Counties of Albany, Schenectady, New York", Stone & Stewart Publishers, 1866 and a map entitled "City Atlas of Albany, New York", G.M. Hopkins, C.E., 1876.

The Albany (Grand Street) non-owned former MGP site is comprised of the former operations of the Albany Gas Light Company. Available historical information indicates that the original MGP operation was located on the Grand Street parcel of the site and that the parcels located north and south of Park Avenue were utilized for gas holders. The approximate location of each of the former gas holders associated with the MGP operation is shown on Figure 3.

Available historical information indicates that the Albany Gas Light Company was the first MGP operation in the City of Albany with the gas works completed in 1845. In 1880, the Albany Gas Light Company and the People's Gas Light Company consolidated under the name of the People's Gas Company (which reportedly operated at the Grand Street site only). In 1886, the People's Gas Company was conveyed to the Municipal Gas Company of the City of Albany (Municipal Gas Company). By 1886, gas operations had resumed at the North Albany site and gas operations at the Grand Street site were phased out. In 1894, the Municipal Gas Company purchased the Albany Electric Illuminating Company (the first large-scale electrical utility for the City of Albany), which was located along Trinity Place (within the current National Grid Trinity Substation). In 1927, the Municipal Gas Company consolidated with the Eastern New York Utilities Corporation to form New York Power & Light Corporation. Niagara Mohawk Power Corporation was formed in 1950 by the consolidation of New York Power and Light Corporation with several additional New York State utility companies.

Based on available information, the original MGP operation was located almost entirely within the limits of the vacant multistory buildings located along Arch Street. The 1876 City Atlas indicates that the northern portion of the Grand Street parcel (the majority of the current substation) was the location of the Perry & Company Stove Works Foundry No. 3. Historical site features associated with the former MGP operations at the Grand Street parcel include a series of horizontal coal retorts that were located in the southern portion of the current substation or the northern portion of the former shirt factory property, the Shaw & McArdle Coal Yard which occupied the southwest corner of the current substation, a gas holder located at the corner of Arch and Grand Streets which was demolished between 1876 and 1892, and the brick and iron gas holder located in the northwest corner of the current substation that was constructed between 1876 and 1892. By 1892, the location of the original MGP operation (the southern portion of the Grand Street parcel) was occupied by carpentry shops, blacksmith shops and storage buildings. By 1909, the coal retorts had been removed and a "coal trestle" is shown at the location where the coal yard was formerly present. A small building located at the corner of Grand Street and Arch Street was occupied by a shirt factory and the former Albany Gas Light Company building at the corner of Arch Street and Trinity Place was used for storage by the Albany Electric Illuminating Company. By 1934, the shirt manufacturing operations expanded to occupy the entire block along Arch Street between Grand Street and Trinity place. Based on the Sanborn maps and substation drawings maintained by National Grid, the gas holder at the northwest corner of the current substation property was demolished between 1950 and 1971.

Historical MGP-related features at the parcels located south of Park Avenue (30 Park Avenue and 15 Warren Street) include an iron gas holder, a small office and gas meter house, and two Albany Gas Light Company-owned buildings located along Warren Street and Phillip Street. The 1866 topographic atlas indicates that a small stream formerly crossed the southern portion of this parcel along Warren Street. The former MGP features on this parcel were constructed between 1866 and 1876. Historical use of the Albany Gas Light Company buildings located along Warren and Phillip Streets is not well documented. The Sanborn map indicates that by 1892 the building along Warren Street was vacant and that the building along Phillip Street was being used for storage. By 1909, the gas holder was noted to be "not in use" and the buildings along Warren Street and Phillip Street were listed as "J.C. Washerback – Wagon Storage and Sales Stable". By 1934, the iron gas holder was gone, although the office and meter house remained and the portion of the parcel where the gas holder was located was listed as "McArdle & Casazza Garages and Warehouse". The garage that currently occupies the former location of the gas holder was constructed between 1934 and 1950.

Historical MGP-related features at the parcel located north of Park Avenue (17 Park Avenue) consist of a gas holder that was constructed prior to 1866. Review of available site maps indicate that the original gas holder on the parcel may have been demolished and replaced by a larger holder at some time between 1866 and 1876. By 1909, the gas holder was gone. The waste recycling building that currently occupies the former location of the gas holder was constructed between 1909 and 1934.

1.2.3 Geologic Conditions

The site is located in the Hudson-Mohawk Lowlands. Glacial Lake Albany covered the eastern third of Albany County from approximately 16,000 to 12,600 years ago (USDA SCS, 1992). The City of Albany was built on Lake Albany clay, which rests on an irregular rock surface with an apparent deep depression directly under the City of Albany (Ruedmann, 1930). Subsurface lithology encountered in the vicinity of the site generally consists of various fill deposits (including silt and clay, sand, concrete, brick, wood, cinders, ash, coal, etc.), typically 10 to 20 feet thick; overlying 10 to over 40 feet of glaciolacustrine clay/silt deposits (described as gray-brown clayey silt to silty clay, moderately plastic, with occasional interbedded silt/fine sand) and till (described as brown gray sandy silt/clay, non-plastic, with some gravel). Bedrock was not encountered during the field activities.

Figure 4 shows the location of two cross-sections (Cross section A-A' and B-B') that were prepared to illustrate generalized subsurface conditions in the vicinity of the site. The geologic cross sections are presented on Figure 5. Cross-section A-A' transects the former gas holder located at Trinity Substation in a north – south direction. Cross-section B-B' transects the former gas holder located at 17 Park Avenue in a northwest – southeast direction, which corresponds to the generalized flow of shallow groundwater at the site. The approximate locations of the former gas holder foundations are shown on the cross-sections.

Based on topography, shallow groundwater is encountered in overburden and flows generally to the south/southeast in the vicinity of the site. Localized flow variations may occur due to anthropogenic influences (e.g., utilities, sumps, pumping, etc.). The Hudson

River, located approximately 2,000 feet east/southeast of the site is a regional discharge point for groundwater. Groundwater was encountered within the fill or the glaciolacustrine clay unit at depths ranging from approximately 8 to 29 feet bgs. Groundwater flow patterns in the vicinity of the site are shown on the potentiometric surface contour map included as Figure 6.

1.3 SUMMARY OF SITE CHARACTERIZATION FINDINGS

A Site Characterization (SC) was performed to characterize the nature and extent of MGP-related and non-MGP-related residuals at the site. The results of the SC are described in detail in the SC Report/RAWP) prepared by ARCADIS (April 2010). The SC investigation was performed between June 2004 and March 2011 by ARCADIS. The investigation included:

- Soil sampling conducted between June 2004 and September 2005.
- Groundwater sampling performed in July 2004, October 2005, and June 2009.
- Soil-gas investigations performed in April 2007 and October 2009.
- Subslab soil vapor investigation performed for the 95 Trinity Place Building in March 2010.

The results of the SC soil investigation indicate that minor potential MGP-related impacts were encountered at the Trinity Substation parcel and in one soil sample collected at a depth of over 25 feet at the 17 Park Avenue parcel. The results for the SC groundwater investigation indicate the presence of minor localized hydrocarbon and volatile organic compound (VOC) impacts. The SC soil-gas investigation identified detected hydrocarbons and VOCs in the soil-gas, however the source of the compounds could not be conclusively determined.

A detailed summary of the results for the SC investigations is presented in the SC Report/RAWP. In general, the results of the SC investigations indicate the following:

1.3.1 Surface Soil

The analytical results for surface soil samples collected at the Trinity Substation and off-site, non-owned properties are presented in Tables 1 through 4 and summarized below.

<u>SVOCs</u>

Select PAHs (including benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected in surface soil samples collected at the 151 Grand Street parcel at concentrations exceeding the restricted use commercial or industrial SCOs. The surface soil PAH concentrations detected at the 151 Grand Street parcel are not associated with the former MGP operations at the site. PAHs were not detected in soil samples collected from the remaining parcels that comprise the site at concentrations exceeding the restricted industrial or commercial use SCOs.

PCBs

Five surface soil samples collected at the Trinity Substation as part of the SC soil investigation were submitted for laboratory analysis for total PCBs. Analytical results indicated that PCBs were not present at detectable levels in any of the surface soil samples.

Inorganics

Inorganic constituents were not detected in any of the surface soil samples at concentrations exceeding the restricted industrial use SCOs presented in 6NYCRR Part 375-6.8. Select inorganic constituents (including beryllium, cadmium, copper, and lead) were detected at surface soil sampling location SS-6 (located at 30 Park Avenue) at concentrations exceeding the restricted commercial use SCOs. Inorganic constituents were not detected in any of the remaining surface soil samples at concentrations exceeding the restricted commercial use SCOs.

1.3.2 Subsurface Soil

The analytical results for subsurface soil samples collected at the Trinity Substation and offsite, non-owned properties are presented in Tables 1 through 4 and shown on Figures 7 through 9. The subsurface soil sample results are summarized below.

BTEX/VOCs

Benzene was detected in the subsurface soil sample recovered from a depth of 16- to 20-feet from location SB-11 (within the former gas holder at the Trinity Substation) at a concentration exceeding the restricted commercial use SCO presented in 6NYCRR 375-6.8. BTEX and VOCs were not detected in any of the other subsurface soil samples collected for the SC soil investigation at concentrations exceeding the restricted commercial or industrial use SCOs.

PAHs/SVOCs

Select SVOCs (including benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected in the soil sample recovered at a depth of 8- to 9.4-feet at location MW-6 (located at the Trinity Substation) at concentrations that exceeded the restricted commercial and industrial use SCOs. Benzo(a)pyrene was also detected in the soil sample recovered at a depth of 12- to 15.2 feet from location SB-2 (located at the Trinity Substation) at a concentration exceeding the restricted commercial and industrial use SCOs. In addition, benzo(a)pyrene and dibenzo(a,h)anthracene were detected in the soil sample collected at a depth of 25- to 26.6 feet at location SB-8 (located at the 17 Park Avenue parcel) at concentrations exceeding the restricted industrial and/or commercial use SCOs. PAHs and SVOCs were not detected in any of the other subsurface soil samples collected for the SC soil investigation at concentrations exceeding the restricted industrial or commercial use SCOs.

PCBs

Six subsurface soil samples collected at the trinity Substation as part of the SC soil investigation were submitted for laboratory analysis for total PCBs. Analytical results indicated that PCBs were not present at detectable levels in any of the subsurface soil samples.

Inorganics

Inorganic constituents were not detected in any of the subsurface soil samples at concentrations exceeding the restricted commercial or industrial use SCOs presented in 6NYCRR Part 375-6.8.

1.3.3 Groundwater

Analytical results obtained for the laboratory analysis of the SC groundwater samples are presented in Tables 5 through 7 and shown on Figures 10 through 12. For the purposes of evaluating the results, the groundwater results have been compared to the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* Class GA Groundwater Quality Standards and Guidance Values (NYSDEC, 1998). Groundwater samples were collected from 14 groundwater monitoring wells located at and in the vicinity of the site. Samples were collected from the wells during two sampling events (2004/2005 and 2009). The evaluation of groundwater sampling results presented below focuses on the extent of MGP-related constituents (i.e., VOCs, SVOCs, inorganics and cyanide) in groundwater; however, other constituents that were detected above the TOGS criteria are also discussed.

VOCs

Select VOCs (including 1,1,1-trichloroethane, 1,1-dichloroethane, benzene, ethylbenzene, styrene, toluene and xylenes) were detected in groundwater samples at concentrations exceeding the NYSDEC-standards and guidance values (SGVs) presented in TOGS 1.1.1. The VOC analytical results for the groundwater samples collected during the 2004/2005 event indicate the following:

- Benzene was detected at three monitoring wells at the Trinity Substation (MW-5, MW-6, and MW-10), and two off-site monitoring wells (MW-8 and MW-11) at concentrations exceeding the SGVs.

- Ethylbenzene, toluene, m,p-xylene, o-xylene, xylene (total), and styrene were detected at monitoring well MW-5 and ethylbenzene, toluene, m,p-xylene, o-xylene, and xylene (total) were detected at monitoring well MW-8 at concentrations exceeding the SGVs.

- 1,1,1–trichloroethane was detected at monitoring well MW-10 and 1,1–dichloroethane was detected at monitoring well MW-8 at concentrations exceeding the SGVs. These compounds are chlorinated VOCs and are not typically related to historical MGP operations.

Only VOCs were analyzed as part of the 2009 groundwater sampling event. The purpose of the additional round of groundwater sampling was to evaluate whether chlorinated VOCs (specifically 1,1,1-trichloroethane [1,1,1-TCA]) were present in MW-10 as indicated during the 2005 sampling event. The sampling results indicated that 1,1,1-TCA was present in the groundwater sample from MW-10 at a concentration of 6.2 ppb, which is generally consistent with the 2005 results of 14 ppb. 1,1,1-TCA was not detected in the other on-site and off-site wells sampled.

SVOCs

Phenol was detected in the groundwater samples collected from monitoring wells MW-5 and MW-6 (adjacent to the former gas holder at the Trinity substation) at an estimated concentration of 3 ppb and 4 ppb respectively which exceeds the SGV presented in TOGS 1.1.1. No other SVOCs were detected in groundwater samples at concentrations exceeding SGVs.

Inorganics

Select metals (including arsenic, beryllium, chromium, copper, iron, mercury, nickel, and zinc) were detected in each of the groundwater samples that were analyzed at concentrations exceeding the NYSDEC ambient water quality SGVs presented in TOGS 1.1.1. The detected metals in the groundwater samples are most likely associated with naturally occurring dissolved minerals and/or particulate matter in the samples collected from the shallow groundwater monitoring wells installed for the SC groundwater investigation. Cyanide was not detected in any of the groundwater samples at concentrations exceeding the SGV presented in TOGS 1.1.1.

1.3.4 Soil Gas

Soil gas samples were collected during 2007 and 2009 to evaluate potential subsurface migration of VOCs detected in groundwater at the Trinity Substation. Analytical results obtained for the laboratory analysis of the SC soil-gas samples are presented in Tables 8 and 9 and shown on Figure 13 and 14. The soil gas sampling results are summarized below.

Soil-Gas Evaluation - 2007

Six soil-gas samples (including one duplicate sample) and two ambient air samples were collected at the Trinity Substation. The analytical results for the soil-gas samples identified detectable concentrations of acetone, methyl ethyl ketone (MEK), 1,1,1-trichloroethane (1,1,1-TCA), 2,2,4-trimethylpentane (commonly referred to as iso-octane), and toluene. Analytical results for the ambient air samples identified detectable concentrations of chloromethane and toluene.

Toluene was detected in four of the soil gas samples and in both ambient air samples. Toluene was not detected in soil-gas sample SG-5. The data from the previous investigations indicated that toluene was present in groundwater at detectable concentrations at monitoring well MW-5; however, other hydrocarbon compounds that were detected at monitoring well locations MW-5 and MW-10 (including benzene, ethylbenzene, xylenes) were not detected at any of the soil-gas sampling locations.

Three common industrial solvents, including acetone, methyl ethyl ketone (MEK), and 1,1,1-TCA were detected in the soil-gas samples. 1,1,1-TCA were previously detected at monitoring well MW-10. However, acetone and MEK have not been detected in groundwater samples collected at the site. These solvents are likely related to industrial activities conducted in the area around the site and are not specifically associated with either National Grid's current electrical substation operations or the historical MGP activities at the site.

Iso-octane was detected in each of the soil gas samples and was not detected in any of the ambient air samples. Iso-octane is a primary component of gasoline. Coal tar and coal tar products do not typically contain iso-octane. National Grid has previously identified iso-octane in soil-gas samples collected using similar sampling procedures at other MGP sites and it is possible that there is some source of systematic sample contamination inherent in the sampling method (such as artifacts from polyethylene tubing or other issues with collecting, transporting, handling, or processing of the samples).

Soil-Gas Evaluation – 2009

In a March 23, 2009 letter to National Grid, the NYSDEC requested additional soil gas sampling to evaluate whether iso-octane, also known as 2,2,4-trimethylpentane, detected in the 2007 soil gas samples was representative of site conditions, or had been introduced as an artifact during the sampling and/or analytical process. Iso-octane was not detected in any of the soil gas samples collected in October 2009, suggesting that previous detections were a result of external introduction during sampling and/or analysis. The NYSDEC also requested that National Grid evaluate the presence of 1,1,1-TCA based on elevated concentrations of this compound during the 2007 soil gas sampling from temporary points in the southeast corner of the Trinity Substation. Soil gas sampling points SG-101 and SG-102 were located at the approximate locations of the previous temporary soil gas points SG-1 and SG-2. Samples obtained from SG-101 and SG-102 contained elevated concentrations of 1,1,1-TCA. These results are consistent with the 2007 results.

1.3.5 Subslab Soil Vapor

The subslab soil vapor investigation for the 95 Trinity Place property was performed in response to a June 23, 2010 letter from the New York State Department of Health (NYSDOH) which requested that National Grid evaluate potential vapor intrusion (VI) issues for the building located at 95 Trinity Place. The subslab soil vapor investigation consisted of the following field activities:

- Building reconnaissance.
- Building product inventory.
- Limited ground penetrating radar (GPR) survey to identify subsurface utilities at proposed subslab sampling locations.
- Installation of four temporary subslab soil vapor sampling points at the locations shown on Figure 15 and collection of soil vapor samples at each sampling point.
- Collection of one outdoor ambient air sample at the location indicated on Figure 15.

The field investigation was completed by ARCADIS from February 28, 2011 to March 3, 2011

Subslab soil vapor and the ambient air sampling results are presented in Table 10. The sub-slab soil vapor investigation results support the following conclusions:

- There is no confirmed soil vapor intrusion pathway for migration of MGP-related or non-MGP-related constituents from the Trinity Substation property to the 95 Trinity Place building.
- The VOCs detected in the subslab soil vapor samples are likely non-MGP related and do not match the results for soil vapor samples collected at the Trinity Substation which is located immediately upgradient from the 95 Trinity Place property.
- With the exception of trichloroethene and chloroform, concentrations of VOCs are less than the NYSDOH-published background indoor air values. Trichloroethene was the only VOC detected at a concentration exceeding the NYSDOH air guidance values.

Some low-level VOCs (e.g., benzene, toluene, ethylbenzene, and xylene) identified in the subslab soil vapor and outdoor ambient air samples are commonly associated with the types of petroleum products that are used and stored inside the basement of the 95 Trinity

Place building. These compounds did not exceed NYSDOH-published background indoor air values or NYSDOH air guidance values.

1.4 SUMMARY OF REMEDIAL ACTIONS

Based on the minor MGP-related and non-MGP-related impacts identified during the SC, remedial activities were not required to address the non-owned parcels associated with the site (including 17 Park Avenue, 30 Park Avenue, 15 Warren Street, 127 Arch Street, and 95 Trinity Place). Intrusive remedial activities were also not required to address the remaining MGP-related and non-MGP-related impacts at the Trinity Substation. Appropriate ICs/ECs to manage the minor MGP-related and non-MGP-related impacts identified at the Trinity Substation parcel were presented in the SC Report/RAWP. The ICs/ECs proposed in the RAWP include:

- Groundwater monitoring to evaluate changes in concentrations of VOCs identified in select groundwater monitoring wells located in the vicinity of the Trinity Substation. Groundwater monitoring activities at the site include:

    - Collection of annual groundwater monitoring samples from seven groundwater monitoring wells (including MW-5, MW-6, MW-7, MW-8A, MW-9, MW-10, and MW-14) for an initial period of 5 years.

    - The abandonment of seven monitoring wells (MW-1 through MW-4, MW-11, MW-12, and MW-13) which are not to be sampled for future groundwater monitoring.

- Execution of a deed restriction to impose requirements on future construction or other subsurface disturbance at the Trinity Substation and restrict potential future residential use of the substation parcel.

- Development and implementation of a Site Management Plan for long term management of remaining MGP-related and non-MGP-related impacts as required by the deed restriction, which includes plans for: (1) Institutional and Engineering Controls, (2) monitoring, (3) operation and maintenance and (4) reporting.

1.4.1 Remaining Site-Related Residuals

The ICs/ECs described in the SC Report/RAWP will address the following minor MGP-related and non-MGP-related impacts which remain at the Trinity Substation parcel:

<u>Soil</u>

The results of the SC soil investigation indicate the minor potential MGP-related impacts were encountered at the Trinity Substation parcel. The Trinity Substation parcel is a restricted access active electrical substation and National Grid has no future plans for other usage of the property. A summary of detected compounds for the soil sampling is shown on Figures 7 through 9.

- Benzene was detected in the subsurface soil sample recovered from a depth of 16- to 20-feet from location SB-11.

- Select SVOCs (including benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected in the soil sample recovered at a depth of 8- to 9.4-feet at location MW-6. Benzo(a)pyrene was also detected in the soil sample recovered at a depth of 12- to 15.2 feet from location SB-2.

Groundwater

The results for the groundwater investigation indicate the presence of minor localized hydrocarbon and VOC impacts; however, the source of the impacts is not clear and there is no use of groundwater in the vicinity of the site. A summary of detected compounds for the groundwater sampling is shown on Figures 10 through 12.

- Select VOCs (including 1,1,1-trichloroethane, 1,1-dichloroethane, benzene, ethylbenzene, styrene, toluene and xylenes) were detected in groundwater samples at concentrations exceeding the NYSDEC-standards and guidance values (SGVs) presented in TOGS 1.1.1.

- Phenol was detected in the groundwater samples collected from monitoring wells MW-5 and MW-6 (adjacent to the former gas holder at the Trinity substation) at an estimated concentration of 3 ppb and 4 ppb respectively which exceeds the SGV presented in TOGS 1.1.1. No other SVOCs were detected in groundwater samples at concentrations exceeding SGVs.

- Select metals (including arsenic, beryllium, chromium, copper, iron, mercury, nickel, and zinc) were detected in each of the groundwater samples that were analyzed at concentrations exceeding the NYSDEC ambient water quality SGVs presented in TOGS 1.1.1. The detected metals in the groundwater samples are most likely associated with naturally occurring dissolved minerals and/or particulate matter in the samples collected from the shallow groundwater monitoring wells installed for the SC groundwater investigation.

Site-Related Soil Vapor Intrusion

The source of the detected hydrocarbons and VOCs (excluding iso-octane, which appears to have been artificially introduced during the 2007 sampling) in the soil-gas samples has not be conclusively determined. However, the soil-gas sampling results indicate that further evaluation of soil-gas or vapor intrusion issues associated with the former MGP operation at the site is not required. A summary of detected compounds for the 2009 soil-gas sampling is shown on Figures 13 and 14.

- Toluene was detected in four of the soil gas samples and in both ambient air samples. Toluene was not detected in soil-gas sample SG-5. The data from the previous investigations indicated that toluene was present in groundwater at detectable concentrations at monitoring well MW-5; however, other hydrocarbon compounds that were detected at monitoring well locations MW-5 and MW-10 (including benzene, ethylbenzene, xylenes) were not detected at any of the soil-gas sampling locations.

- Three common industrial solvents, including acetone, methyl ethyl ketone (MEK), and 1,1,1-trichloroethane (1,1,1-TCA) were detected in the soil-gas samples. 1,1,1-TCA was previously detected at monitoring well MW-10. However, acetone and MEK have not been detected at monitoring well locations MW-5 or MW-10. These solvents are likely related to industrial activities conducted in the area around the site and are not specifically associated with either National Grid's current electrical substation operations or the historical MGP activities at the site.

- Analytical results for the ambient air samples identified detectable concentrations of chloromethane and toluene.

2.0 ENGINEERING AND INSTITUTIONAL CONTROL PLAN

2.1 INTRODUCTION

2.1.1 General

Since impacted soil and groundwater remains at the site, ECs and ICs have been implemented to protect human health and the environment. This Engineering and Institutional Control Plan (EICP) describes the procedures for implementation and management of ECs and ICs at the site. This EICP is one component of the SMP and is subject to revision by NYSDEC.

2.1.2 Purpose

This plan provides:

- A description of all ECs and ICs at the site.
- The basic implementation and intended role of each EC and IC.
- A description of the key components of the ICs set forth in the deed restriction.
- A description of the features to be evaluated during each required inspection and annual review.
- A description of plans and procedures to be followed for implementation of ECs and ICs, such as the Excavation Work Plan (provided in Appendix B) for the proper handling of remaining MGP-related impacts that may be disturbed during maintenance or redevelopment work on the site.
- Any other provisions necessary to identify or establish methods for implementing the ECs and ICs required by the site remedy, as determined by the NYSDEC.

2.2 ENGINEERING CONTROLS

2.2.1 Engineering Control Systems

<u>2.2.1.1 Barrier Layer</u>

Exposure to remaining MGP-related and non-MGP-related impacts in subsurface media at the Trinity Substation is prevented by the existing buildings and gravel/asphalt cover which act as a barrier layer. The cover material types/extent is shown on Figure 16. The Excavation Work Plan outlines procedures that will be implemented in the event the barrier layer is breached, penetrated, or temporarily removed, and any underlying remaining impacts are disturbed. Procedures for inspection and maintenance of this cover are provided in Section 3.4 of this SMP.

2.2.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered to be complete when effectiveness monitoring indicates that the remedy has achieved the remedial action objectives identified in the NYSDEC-approved RAWP. The framework for determining when remedial processes are complete is provided in NYSDEC DER-10.

2.2.2.1 Barrier Layer

The barrier layer (including the existing buildings and the gravel/asphalt pavement cover) is a permanent control and the quality and integrity of this system will be inspected at regular intervals as discussed in the Monitoring Plan (MP) presented in Section 3 of this SMP.

2.2.2.2 Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will be performed for five years. Following the completion of the fifth annual groundwater monitoring event, the results for the annual monitoring activities will be evaluated by National Grid and reviewed with the NYSDEC. At that time, if VOC levels are consistent with previous sampling results or have decreased to levels that are below applicable New York SGVs, the groundwater monitoring program may be reduced in scope/frequency or terminated.

2.3 INSTITUTIONAL CONTROLS

ICs are required by the SC Report/RAWP to: (1) implement, maintain and monitor ECs; (2) prevent future exposure to remaining impacts by controlling disturbance of subsurface media; (3) prevent future exposure to remaining impacts by precluding the use of onsite groundwater for potable and industrial uses; and, (4) limit the use and development of the site to industrial uses only. Adherence to these ICs for the site is required by the deed restriction and will be implemented under this SMP. These ICs are:

- Compliance with the deed restriction (Appendix A) and this SMP by the Grantor (National Grid) and the Grantor’s successors and assigns.

- The ECs must be maintained as specified in this SMP.

- The ECs at the site must be inspected at a frequency and in a manner defined in this SMP.

- Groundwater monitoring and other environmental/public health monitoring will be performed as defined in this SMP.

- Data and information pertinent to management of the site must be reported at the frequency and in a manner defined in this SMP.

ICs identified in the deed restriction may not be discontinued without an amendment to or extinguishment of the deed restriction.

The site has a series of ICs in the form of site restrictions. Adherence to these ICs is required by the deed restriction. Site restrictions include:

- The property may only be used for restricted commercial/industrial use provided that the long-term ECs and ICs included in this SMP are employed.

- The property may not be used for a higher level of use, such as unrestricted and restricted residential use without additional remediation and amendment of the deed restriction, as approved by the NYSDEC.

- Future activities at the site that will disturb remaining impacted material must be conducted in accordance with this SMP.

- The use of the groundwater underlying the property is prohibited without treatment rendering it safe for intended use.

- The potential for vapor intrusion must be evaluated for any buildings developed in the Trinity Substation area and any potential impacts that are identified must be monitored or mitigated.

- Vegetable gardens and farming on the property are prohibited.

- National Grid will submit an annual Certification Statement to the NYSDEC which certifies that: (1) controls employed at the site are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitutes a violation or failure to comply with the SMP. NYSDEC retains the right to access the property at any time in order to evaluate the continued maintenance of any and all controls. This Certification Statement shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by a licensed New York State Professional Engineer.

2.3.1 Excavation Work Plan

Based on the SC/RAWP, the site is acceptable for restricted commercial or industrial use. Any future intrusive work that will penetrate the barrier layer, or encounter or disturb the remaining impacts, including any modifications or repairs to the existing barrier layer, will be performed in compliance with the Excavation Work Plan (EWP) that is attached as Appendix B to this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the site. An example HASP and CAMP that cover on-going monitoring activities at the site are presented in Appendix C and Appendix D, respectively. Prior to conducting any future work covered under the EWP, a project-specific HASP and CAMP will be submitted to the NYSDEC with the notification provided in Section B-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be documented in the Annual Review Report (See Section 5).

National Grid and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are responsible for the safe performance of all intrusive work, the structural integrity of excavations, proper disposal of water generated by excavation de-watering, control of runoff from open excavations, and for structures that may be affected by excavations (such as building foundations). National Grid is also responsible for ensuring that future site development activities will not interfere with, or otherwise impair or compromise, the ECs described in this SMP.

2.3.2 Soil Vapor Intrusion Evaluation

Prior to the future construction of any enclosed structures located over onsite areas where remaining subsurface MGP-related and non-MGP-related impacts have been identified (see Figures 13 and 14), National Grid will perform an SVI evaluation to characterize the potential exposure of future occupants to chemical constituents as a result of the SVI pathway. Considerations for development of an SVI evaluation approach will include:

- Representative soil vapor samples will be collected in areas with known or suspected sources of volatile constituents, in areas where elevated field screening readings have been noted during previous investigation activities, and in areas where VOCs have been identified in groundwater.

- For areas of the site where there is limited information on potential sources of volatile constituents, soil vapor samples will be collected in a grid pattern across the footprint of the proposed structure.

- Soil vapor samples will be collected at multiple depths from suspected or former source areas, to a depth that is comparable to the expected foundation depth for the proposed structure.

Alternatively, an SVI mitigation system may be installed as an element of the building foundation without first conducting an investigation. If installed, this mitigation system may include a vapor barrier and passive sub-slab depressurization system that is capable of being converted to an active system.

Prior to conducting an SVI evaluation or installing a mitigation system, a work plan will be developed and submitted to the NYSDEC and NYSDOH for approval. This work plan will be developed in accordance with the most recent NYSDOH *Guidance for Evaluating Vapor Intrusion in the State of New York*. Measures to be employed to mitigate potential vapor intrusion will be evaluated, selected, designed, installed, and maintained based on the SVI evaluation, the NYSDOH guidance, and construction details for the proposed structure.

Preliminary (unvalidated) SVI sampling data will be forwarded to the NYSDEC and NYSDOH for initial review and interpretation. Upon validation, the final data will be transmitted to the agencies, along with a recommendation for follow-up action, if necessary.

SVI sampling results, evaluations, and follow-up actions will also be summarized in the next Annual Review Report.

2.4 INSPECTIONS AND NOTIFICATIONS

2.4.1 Inspections

Inspections of remedial components at the site will be conducted at the frequency specified in the MP schedule. A comprehensive site-wide inspection will be conducted annually in conjunction with annual groundwater monitoring. The inspections will determine and document the following:

- Whether ECs 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 deed restriction.
- Sampling and analysis of appropriate media during monitoring events.
- If site records are complete and up to date.
- Changes, or needed changes, to the monitoring system.

Inspections will be conducted in accordance with the procedures set forth in Section 3 of this SMP. Reporting requirements are outlined in Section 5 of this SMP.

If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs, an inspection of the site will be conducted within 5 days of the event to verify the continued effectiveness of the EC/ICs implemented at the site. Inspections will be conducted by a qualified environmental professional as approved by the NYSDEC.

2.4.2 Notifications

Notifications will be submitted by National Grid to the NYSDEC as needed for the following reasons:

- 60-day advance notice of any proposed changes in site use as required under the terms of the VCA, 6 NYCRR Part 375, and/or Environmental Conservation Law.

- 15-day advance notice of any proposed ground-intrusive activities pursuant to the Excavation Work Plan.

- Notice within 48-hours of any damage or defect to foundations or structures that reduces or has the potential to reduce the effectiveness of other ECs and likewise any action to be taken to mitigate the damage or defect.

- Notice within 48-hours 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, including 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 shall be submitted to the NYSDEC within 45 days and shall describe and document actions taken to restore the effectiveness of the ECs.

Any change in the ownership 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 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 the VCO, 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.

2.5 CONTINGENCY PLAN

This Contingency Plan outlines response activities to be implemented in the event of an emergency. Emergencies may include injury to personnel, fire or explosion, environmental release, or serious weather conditions.

2.5.1 Emergency Telephone Numbers

In the event of any environmentally related situation or unplanned occurrence requiring assistance, the Owner or Owner’s representative(s) should contact the appropriate party from the contact list below. For emergencies, appropriate emergency response personnel should be contacted. This emergency contact lists must be maintained in an easily accessible location at the site.

Table 2-1: Emergency Contact Numbers

Medical	911 (Ambulance) or (518) 262-3125 (Hospital)
Fire	911
Police	911

Utility Markout/Clearance One Call Center (DigSafely NY):	(800) 962-7962 or 811 (3 day notice required for utility markout)
Poison Control Center:	(800) 222-1222
Pollution Toxic Chemical Oil Spills:	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362

Table 2-2: Other Contact Numbers

National Grid Project Manager: James Morgan	(315) 428-3101
NYSDEC Project Manager: R. Scott Deyette	(518) 402-9662
NYSDOH Project Manager: Maureen Schuck	(800) 458-1158 ext 2-7860

* Note: Contact numbers subject to change and should be updated as necessary

2.5.2 Map and Directions to Nearest Health Facility

Site Location: 150 Grand Street, Albany, NY 12202

Nearest Hospital Name: Albany Medical Center

Hospital Location: 43 New Scotland Avenue, Albany, NY 12208

Hospital Telephone: (518) 262-3125

Directions to the Hospital:

1. Head southwest on Grand Street toward Park Avenue

2. Turn right on Morton Avenue

3. Continue onto Holland Avenue

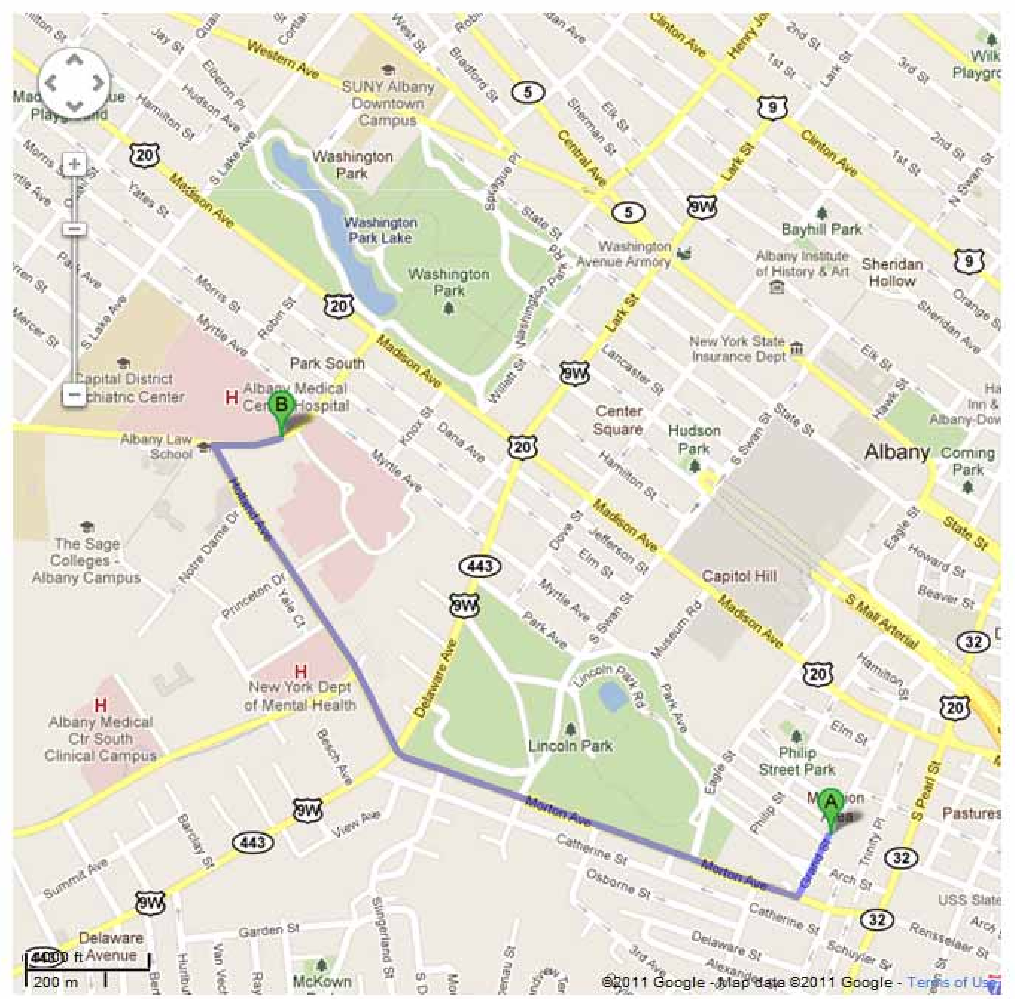
4. Turn right on New Scotland Avenue

5. Arrive at 43 New Scotland Avenue (Albany Medical Center)

Total Distance: 1.4 miles.

Total Estimated Time: 5 minutes.

Map Showing Route from the site to the Hospital:



2.5.3 Response Procedures

As appropriate, the fire department and other emergency response group will be notified immediately by telephone of the emergency. The emergency telephone number list is found at the beginning of this Contingency Plan (Table 2-1).

Spill Response Plan

Spill response procedures have been developed for responding to unplanned release of oil, products, materials, hazardous waste, etc. to soil, surface water, or groundwater. All spills of materials associated with the remaining MGP-related and non-MGP-related impacts at the site will be immediately reported to National Grid's Project Manager and/or the other contacts included in Table 2-2. In addition, reportable spills will be called in to the NYSDEC spills hotline upon discovery. Properly trained personnel will implement the following general spill response procedures (when possible):

1. *Ceasing Operation of the Affected Equipment*: This will consist of shutting off the equipment and/or closing any valves and stopping the leak, if possible.

2. *Containing the Spill*: If the spilled material is floating on a water surface, spill-absorbent pads/booms will be placed across the path of the floating spill. If the spilled material sinks below the water surface, a dam, weir, or other containment method will be used to stop the flow of the spilled material. If the spill occurs on land, a ditch, dam, or other containment unit will be constructed to stop the flow of the spilled material. Absorbent material will be applied as necessary.

3. *Cleaning Up the Spill:* Spills in water will be recovered using pumps, sorbent material, etc. as necessary until the spilled material is recovered (and no sheen or other evidence of the spill is observed on the water surface). Spills on land shall be recovered using pumps, sorbent material, and heavy equipment, as necessary until the spilled material is recovered. Other activities to be conducted during spill cleanup activities include: removing impacted soil/sorbent pads; using rags and cleaning solution to remove excess spilled material from equipment; and collecting verification samples to confirm that the impacted soil has been removed.

4. *Containerizing Spill Materials:* Spill materials, impacted soil, sorbent pads, etc. will be containerized in New York State Department of Transportation- (NYSDOT-) approved containers. The containers will be labeled with the waste type and date of accumulation in accordance with applicable regulations contained in 49 CFR Part 172. Samples will be collected to characterize the spilled materials for disposal (i.e., as a hazardous/non-hazardous waste and/or TSCA/non-TSCA waste, if necessary).

5. *Disposing of Spill Materials:* Impacted materials and spill cleanup debris will be disposed of at a facility permitted to accept the materials. National Grid will be responsible for the coordination of the disposal activities.

6. *Performing Post-Spill Maintenance:* Following cleanup of the spill, National Grid will ensure that all used spill cleanup material and equipment has been disposed of or cleaned, as appropriate. If the equipment that caused the spill (if applicable) cannot be properly repaired, replacement equipment shall be obtained.

In the event that the release is of sufficient magnitude and cannot be controlled by diking, damming, absorbing, or other method, the local fire department, NYSDEC, and National Response Center shall be notified.

Evacuation Plan

If evacuation of the site is necessary, onsite personnel shall evacuate the site via the nearest safe route and will gather at the main gate located on the southwest portion of the site located along Grand Street. Attendance will be taken to verify that all onsite personnel are present. In the event of an injury to onsite personnel, emergency procedures outlined in the Health and Safety Plan should be followed. Emergency vehicles entering the site, if necessary, will enter along through the main gate located on Grand Street.

3.0 SITE MONITORING PLAN

3.1 INTRODUCTION

3.1.1 General

This Monitoring Plan (MP) describes the measures for evaluating the performance and effectiveness of the remedy in reducing or mitigating MGP-related and non-MGP-related impacts at the site, the effectiveness of the barrier layer in controlling exposures to onsite personnel, and the groundwater monitoring activities at the site. This MP may only be revised with the approval of NYSDEC. Monitoring will be performed for five years. Following the completion of the fifth annual monitoring event, the results for the annual monitoring activities will be evaluated by National Grid and reviewed with the NYSDEC. At that time, if VOC levels are consistent with previous sampling results or have decreased to levels that are below applicable New York SGVs, the annual inspection/groundwater monitoring program may be reduced in scope/frequency or terminated.

3.1.2 Purpose and Schedule

This MP describes the methods to be used for:

- Monitoring groundwater quality and flow conditions.
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly ambient groundwater standards.
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.
- Preparing necessary reports for monitoring activities.

To adequately address these issues, this MP provides information on:

- Fluid level monitoring procedures.
- Sampling locations, protocol, and frequency.
- Information on all designed monitoring systems (e.g., well logs).
- Analytical sampling program requirements.
- Reporting requirements.

- Quality Assurance/Quality Control (QA/QC) requirements.
- Inspection and maintenance requirements for monitoring wells.
- Monitoring well decommissioning procedures.
- Annual inspection and periodic certification.

Annual monitoring at Trinity Substation will be conducted for the first five years. The frequency thereafter will be determined by NYSDEC. Monitoring programs are summarized below in Table 3-1 and outlined in detail in Sections 3.2 and 3.3.

Table 3-1: Monitoring/Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
1	Annual	Groundwater	Fluid levels at all onsite monitoring wells
2	Annual	Groundwater	Sampling of all remaining monitoring wells for TCL VOCs

1. TCL = Target Compound List.
2. * The frequency of events will be conducted as specified until otherwise approved by NYSDEC and NYSDOH.

3.2 BARRIER LAYER MONITORING

The barrier layer of the area subject to this SMP shall be evaluated annually in conjunction with the annual groundwater monitoring. Since the remaining MGP-related impacts are only encountered at depths of several feet or more below grade, the annual inspections will focus on maintaining physical separation between on-site workers and the remaining MGP-related impacts. The evaluation will include a visual inspection of the Trinity Substation including the building locations and the asphalt/gravel cover (shown on Figure 16) for any evidence of recent excavation/subsurface utility work, erosion or removal of cover materials (asphalt, gravel. fill, etc.), or other pathways that could potentially result in exposure of on-site workers to subsurface MGP-related impacts.

The NYSDEC shall be notified of significant items (i.e., items where measures are needed to prevent contact with, or migration of, impacted soils within the site) promptly following inspection. All observed changes shall be documented in the annual report discussed in Section 5.3. A sample Site Inspection Form is included in Appendix E. Any needed repairs shall be made promptly.

3.3 MEDIA MONITORING PROGRAM

3.3.1 Groundwater Monitoring

Groundwater monitoring will be performed annually for five years to assess groundwater quality at the site. Monitoring wells MW-5, MW-6, MW-7, MW-8A, MW-9, MW-10 and MW-14, shown on Figure 17, will be sampled during monitoring activities. Table 11 summarizes monitoring well construction details. Monitoring well construction logs are included in Appendix F.

The network of monitoring wells has been designed based on the following criteria:

- Evaluate the groundwater quality of the overburden fill.

- Evaluate the groundwater flow pattern.

- Evaluate the groundwater concentrations of COCs.

- Confirm that groundwater quality (VOCs [as defined in Section 3.3.1.1]) is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

Deliverables for the groundwater monitoring program are specified in Section 3.5.

3.3.1.1 Sampling Protocol

All monitoring well sampling activities will be recorded in a field book and documented on groundwater sampling field forms included in the Field Sampling Plan (FSP) presented in Appendix G. Field observations (e.g., well integrity, etc.) will be noted on the well sampling log which will serve as the inspection form for the groundwater monitoring well network.

Groundwater samples will be collected from the seven monitoring wells listed above and submitted to a certified analytical laboratory. The samples will be analyzed for TCL VOCs in accordance with USEPA SW-846 Methods, as referenced in the NYSDEC 2005 ASP. QA/QC samples (including trip blank, field duplicate, matrix spike, and matrix spike duplicate samples) will be collected and submitted for laboratory analyses for each annual sampling event, as referenced in the Quality Assurance Project Plan (QAPP) presented in Appendix H.

Prior to sampling, the headspace within each well will be measured with a PID and a round of groundwater level measurements will be obtained. Groundwater levels at each well will be measured to the nearest one-hundredth of a foot from a reference point at the top of the inner well casing. An oil/water level interface probe and/or a water level indicator will be used to measure the depth to the water table and thickness of any free product in the wells. The measurements will be converted to elevations (referenced to a site-specific datum). The groundwater elevation information will be used in conjunction with the hydraulic conductivity data (presented in the SC Report/RAWP) to further evaluate horizontal groundwater flow gradients beneath the site.

Prior to collecting groundwater samples, each monitoring well will be purged using a polyethylene bailer to remove a minimum of approximately three well volumes. At intervals of every 5 to 10 minutes during purging, groundwater field parameter measurements will be obtained for water removed from the well, including pH, conductivity, turbidity, oxidation reduction potential (ORP) and dissolved oxygen. Well purging will continue until a minimum of three well volumes have been removed and the turbidity of the purge water been reduced to less than approximately 50 nephelometric turbidity units (NTUs), If turbidity remains above 50 NTUs following the removal of three well volumes, purging will continue until the other field parameters are relatively stable (within 5 to 10% on successive rounds). Following purging, groundwater samples will be collected from the seven monitoring wells indicated above using a disposable polyethylene bailer and the groundwater samples will be submitted for laboratory analysis.

All sampling and analyses will be performed in accordance with the requirements of the QAPP prepared for the site (Appendix H). Main components of the QAPP include:

- QA/QC Objectives for Data Measurement.
- Sampling Program Requirements, including preparation and handling of sample containers, sample holding times, and field QC requirements.
- Sample Tracking and Custody.
- Calibration Procedures for field and laboratory equipment.
- Analytical Procedures.
- Preparation of a Data Usability Summary Report (DUSR), which will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.
- Internal QC and Checks.
- QA Performance and System Audits.
- Preventative Maintenance Procedures and Schedules.
- Corrective Action Measures.

3.3.1.2 Monitoring Well Repairs, Replacement And Decommissioning

If biofouling or silt accumulation occurs in the monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced (as per the MP), if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

In accordance with the NYSDEC-approved SC Report/RAWP, decommissioning of monitoring wells MW-1 through MW-4, MW-11, MW-12, and MW-13 has previously been completed. These wells will be decommissioned because they are not required for ongoing groundwater monitoring in connection with the site. The wells were decommissioned in general conformance with ASTM International (ASTM) Method D5299 (ASTM, 2005) and in accordance with Section 2 of the NYSDEC guidance document titled Groundwater Monitoring Well Decommissioning Procedures (NYSDEC, 1996). All existing well construction materials (i.e., casing, grout, and sand pack) were removed by overdrilling each well. Following removal of the well construction materials, the borehole was tremie-grouted with a cement/grout mixture to the ground surface. The removed materials were containerized, handled, and transported for off-site treatment and/or disposal in accordance with applicable regulations.

For remaining monitoring well at the site, the NYSDEC will be notified prior to any repair or decommissioning/replacement of monitoring wells, and the repair or decommissioning/replacement process will be documented in the subsequent Annual Review Report. Well decommissioning without replacement will be done only with prior approval of the NYSDEC. Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

3.4 SITE-WIDE INSPECTION

Site-wide inspections will be performed on an annual basis in conjunction with the annual groundwater monitoring event. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices (if any). During these inspections, an Inspection Form will be completed (Appendix E). The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage.
- An evaluation of the condition and continued effectiveness of ECs.
- General site conditions at the time of the inspection.

- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection.

- Confirm that site records are up to date.

3.5 MONITORING REPORTING REQUIREMENTS

Forms and any other information generated during regular monitoring events and inspections will be kept in a central project file. All forms, and other relevant reporting formats used during the monitoring/inspection events, will be (1) subject to approval by NYSDEC and (2) submitted at the time of the Annual Review Report.

All monitoring results will be reported to NYSDEC on an annual basis in the Annual Review Report. The letter report will include, at a minimum:

- Date of event.

- Personnel conducting sampling.

- Description of the activities performed.

- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc).

- Copies of all completed field forms (e.g., well sampling logs, chain-of-custody documentation, etc.).

- Sampling results in comparison to appropriate standards/criteria.

- A figure illustrating sample type and sampling locations.

- Copies of all laboratory data sheets and the required laboratory data deliverables required for all sampling locations (to be submitted electronically with the Annual Review Report).

- Any observations, conclusions, or recommendations.

- A determination as to whether groundwater conditions have changed since the last reporting event.

Data will be reported in hard copy or digital format as determined by NYSDEC. A summary of the monitoring program deliverables are summarized in Table 3-2 below.

Table 3-2: Schedule of Monitoring/Inspection Reports

Task	Reporting Frequency*
Groundwater Monitoring	Annual
Site-Wide Inspection	Annual

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

4.0 OPERATION AND MAINTENANCE PLAN

4.1 INTRODUCTION

The site remedy does not rely on any mechanical systems, such as sub-slab depressurization systems or air sparge/ soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

5. INSPECTIONS, REPORTING AND CERTIFICATIONS

5.1 GENERAL

This section of the SMP presents a discussion of site inspection, annual certification, and annual reporting requirements in connection with the ECs and ICs for the site.

5.2 SITE INSPECTIONS

5.2.1 Inspection Frequency

All inspections will be conducted at the frequency specified in Section 3 of the MP. At a minimum, a site-wide inspection will be conducted annually. Inspection of remedial components will also be conducted whenever a severe condition has taken place, such as an erosion or flooding event that may affect the ECs.

5.2.2 Inspection Forms, Sampling Data, and Maintenance Reports

All inspections and monitoring events will be recorded on appropriate forms, including the Site-Wide Inspection Form included in Appendix E and the field sampling forms included in the FSP (Appendix G). These forms are subject to NYSDEC review and revision.

All applicable inspection forms and other records, including all media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format in the Annual Review Report.

5.2.3 Evaluation of Records and Reporting

The results of the inspection and site monitoring data will be evaluated in the Annual Review Report to confirm that the:

- EC/ICs are in place, are performing properly, and remain effective.
- The MP is being implemented.
- The site remedy continues to be protective of public health and the environment and is performing as designed in the RAWP.

5.3 CERTIFICATION OF INSTITUTIONAL CONTROLS

Each Annual Review Report (to be prepared as discussed under Section 5.4) will include a Certification Statement signed by a licensed New York State Professional Engineer which will indicate (if applicable):

- The ICs employed at this site are unchanged from the date the controls were put in place, or last approved by the Department.
- Nothing has occurred that would impair the ability of the controls to protect public health and environment.
- Nothing has occurred that would constitute a violation or failure to comply with any requirements for the ICs.
- Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of the ICs.
- Use of the site is compliant with the deed restriction.
- The information presented in this report is accurate and complete.
- That all information and statements in this certification form are true.

The signed Certification Statement will be included in the Annual Review Report described below in Section 5.4.

5.4 ANNUAL REVIEW REPORT

An Annual Review Report will be submitted to the Department every year, beginning eighteen months after the Certificate of Completion or equivalent document (e.g., Satisfactory Completion Letter) is issued. In the event that the site is subdivided into separate parcels with different ownership, a single Annual Review Report will be prepared that addresses the entire site. The report will be prepared in accordance with NYSDEC DER-10 and submitted within 45 days of the end of each certification period. Media sampling results will also be incorporated into the Annual Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.

- All applicable inspection forms and other records generated for the site during the reporting period in electronic format.

- Data summary tables and graphical representations of potential constituents of concern by media which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format.

- A site evaluation, which includes the following:

    - Compliance with the requirements of the site-specific SC Report/RAWP.

    - Any new conclusions or observations regarding impacted areas at the site based on inspections or data generated by the MP.

    - Recommendations regarding any necessary changes to the remedy and/or MP.

    - The overall performance and effectiveness of the remedy.

The Annual Review Report will be submitted, in hard-copy format, to the NYSDEC Central Office and Regional Office in which the site is located, and in electronic format to NYSDEC Central Office, Regional Office and the NYSDOH Bureau of Environmental Exposure Investigation.

5.5 CORRECTIVE MEASURES PLAN

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an EC or IC, a Corrective Measures Plan will be submitted to the NYSDEC 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 Plan until it is approved by the NYSDEC.

Tables

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-1		MW-2		MW-3A		MW-4	
Sample Depth(Feet):	Industrial	Commercial	28 - 30	36 - 38	4.7 - 5.7	32 - 34	14 - 16	24 - 26	8 - 10	28 - 30
Date Collected:	(Bold)	(Shaded)	06/15/04	06/15/04	06/18/04	06/18/04	06/25/04	06/25/04	06/22/04	06/22/04
1,1-Dichloroethane	480	240	<0.014	<0.013	<0.013	<0.010 J	<0.014	<1.6	<0.012	<0.011 J
2-Butanone	1,000	500	<0.014 J	<0.013 J	0.027 J	<0.010 J	<0.014 J	1.7 J	<0.012	<0.011 J
Acetone	1,000	500	<0.014 J	0.0090 J	0.23 J	0.029 J	0.061 J	<1.6 J	0.0060 J	0.0050 J
Benzene	89	44	<0.014	<0.013	0.0040 J	0.0050 J	<0.014	2.6	<0.012	<0.011 J
Carbon Disulfide	- -	- -	<0.014	<0.013	<0.013	<0.010 J	<0.014	<1.6	<0.012	<0.011 J
Cyclohexane	- -	- -	0.017	<0.013	0.11	<0.010 J	<0.014	<1.6	<0.012	<0.011 J
Ethylbenzene	780	390	<0.014 J	<0.013	<0.013 J	<0.010 J	<0.014 J	<1.6	<0.012	<0.011 J
Isopropylbenzene	- -	- -	<0.014 J	<0.013	0.012 J	<0.010 J	<0.014	<1.6	<0.012	<0.011 J
Methyl Acetate	- -	- -	<0.014 J	<0.013 J	<0.013 J	<0.010 J	<0.014 J	<1.6	<0.012	<0.011 J
Methylcyclohexane	- -	- -	<0.014	<0.013	0.48 DJ	<0.010 J	<0.014	<1.6 J	<0.012	<0.011 J
Methylene Chloride	1,000	500	0.0030 J	<0.013	0.17 J	<0.010 J	0.025	<1.6	<0.012	0.0020 J
Methyl-tert-butyl ether	1,000	500	<0.014	<0.013	<0.013	<0.010 J	<0.014	<1.6	<0.012	<0.011 J
Styrene	- -	- -	<0.014 J	<0.013	<0.013 J	<0.010 J	<0.014 J	<1.6	<0.012	<0.011 J
Toluene	1,000	500	0.0030 J	<0.013	0.014 J	<0.010 J	<0.014 J	<1.6	<0.012	<0.011 J
Xylene (total)	1,000	500	<0.014 J	<0.013	0.019 J	<0.010 J	<0.014 J	<1.6	<0.012	<0.011 J

See notes on page 8.

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-5		MW-6		MW-7		MW-8	
Sample Depth(Feet):	Industrial	Commercial	16 - 17.6	30 - 32	8 - 9.4	14.6 - 15.3	14 - 16	24 - 26	11.3 - 13.1	18 - 20
Date Collected:	(Bold)	(Shaded)	06/09/04	06/09/04	06/23/04	06/23/04	06/14/04	06/14/04	06/23/04	06/22/04
1,1-Dichloroethane	480	240	<0.013	<0.013 [<0.012]	<0.014	<0.012	<0.013	<0.013 J	<0.013	0.0030 J
2-Butanone	1,000	500	<0.013	<0.013 [<0.012]	0.0060 J	0.0040 J	<0.013 J	<0.013 J	0.014	<0.012
Acetone	1,000	500	0.0060 J	0.0070 J [0.0090 J]	0.032	0.021 J	<0.013 J	0.0070 J	0.044 J	<0.012 J
Benzene	89	44	<0.013	8.0 D [6.2 D]	<0.014	0.51	<0.013	<0.013 J	0.032	<0.012
Carbon Disulfide	- -	- -	<0.013	<0.013 [<0.012]	0.0070 J	0.0050 J	<0.013	<0.013 J	<0.013	<0.012
Cyclohexane	- -	- -	<0.013	<0.013 [<0.012]	<0.014	0.0040 J	<0.013	<0.013 J	0.22	<0.012
Ethylbenzene	780	390	<0.013	7.8 D [5.4 DJ]	<0.014	0.048	<0.013	<0.013 J	0.075	<0.012
Isopropylbenzene	- -	- -	<0.013	0.24 DJ [0.0030 J]	<0.014	0.0030 J	<0.013	<0.013 J	0.033	<0.012
Methyl Acetate	- -	- -	<0.013	<0.013 [<0.012]	<0.014	0.0020 J	<0.013 J	<0.013 J	<0.013	<0.012
Methylcyclohexane	- -	- -	<0.013	0.0030 J [0.0050 J]	<0.014	<0.012	<0.013	<0.013 J	NA	<0.012
Methylene Chloride	1,000	500	<0.013	0.0040 J [<0.012]	<0.014	<0.012	<0.013	<0.013 J	<0.013	<0.012
Methyl-tert-butyl ether	1,000	500	<0.013	<0.013 [<0.012]	<0.014	<0.012	<0.013	<0.013 J	<0.013	<0.012
Styrene	- -	- -	<0.013	16 D [13 D]	<0.014	0.0050 J	<0.013	<0.013 J	<0.013	<0.012
Toluene	1,000	500	<0.013	8.1 D [7.9 D]	<0.014	0.37	<0.013	<0.013 J	0.0080 J	<0.012
Xylene (total)	1,000	500	<0.013	22 D [17 DJ]	<0.014	0.040	<0.013	<0.013 J	0.12	<0.012

See notes on page 8.

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-9	MW-10		MW-11	MW-12	MW-13	
Sample Depth(Feet): Date Collected:	Industrial (Bold)	Commercial (Shaded)	10 - 12 05/12/05	10 - 12 05/11/05	12 - 14 05/11/05	14 - 16 05/12/05	5 - 7 05/16/05	8 - 10 09/06/05	14 - 16 09/06/05
1,1-Dichloroethane	480	240	<0.013 J	<0.013	<0.013 J	<0.013 J	<0.013	<0.0068	<0.0053
2-Butanone	1,000	500	<0.013	<0.013	<0.013	0.0050 J	<0.013 J	<0.017	<0.013
Acetone	1,000	500	<0.021	<0.013	<0.013 J	<0.035 J	<0.013	<0.017	<0.013
Benzene	89	44	<0.013	0.0040 J	0.013	0.011 J	<0.013	<0.0068	<0.0053
Carbon Disulfide	- -	- -	<0.013 J	<0.013 J	<0.013 J	<0.013 J	<0.013	<0.0068	<0.0053
Cyclohexane	- -	- -	<0.013	<0.013	<0.013	<0.013	<0.013	<0.0068	<0.0053
Ethylbenzene	780	390	<0.013	0.0040 J	0.020	<0.013	<0.013	<0.0068	<0.0053
Isopropylbenzene	- -	- -	<0.013	<0.013	<0.013	<0.013	<0.013	<0.0068	<0.0053
Methyl Acetate	- -	- -	<0.013 J	<0.013 J	<0.013 J	<0.013 J	<0.013 J	<0.0068	<0.0053
Methylcyclohexane	- -	- -	<0.013	<0.013	<0.013	<0.013	<0.013	<0.0068	<0.0053
Methylene Chloride	1,000	500	<0.013 J	<0.013 J	<0.013 J	<0.013	<0.013	<0.0068	<0.0053
Methyl-tert-butyl ether	1,000	500	<0.013	<0.013 J	<0.013	<0.013	<0.013	0.0033 J	<0.0053
Styrene	- -	- -	<0.013	0.013	0.076	<0.013	<0.013	<0.0068	<0.0053
Toluene	1,000	500	<0.013	0.021	0.11	<0.013	0.0070 J	<0.0068	<0.0053
Xylene (total)	1,000	500	<0.013	0.072	0.37	<0.013	<0.013	<0.021	<0.016

See notes on page 8.

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-14		SB-1		SB-2		SB-3	
Sample Depth(Feet):	Industrial	Commercial	14 - 16	20 - 22	8 - 11	14.5 - 15.4	8 - 9	12 - 15.2	10 - 12	22 - 24
Date Collected:	(Bold)	(Shaded)	09/09/05	09/09/05	06/11/04	06/11/04	06/21/04	06/21/04	06/17/04	06/17/04
1,1-Dichloroethane	480	240	<0.0066 [<0.0067]	<0.0066	<0.013	<0.013	<0.013	<0.014	<0.015	<1.6
2-Butanone	1,000	500	<0.016 [<0.017]	<0.016	<0.013	<0.013	<0.013	0.0030 J	<0.015 J	<1.6 J
Acetone	1,000	500	<0.016 [<0.017]	<0.016	0.0090 J	0.027	<0.013 J	0.014 J	0.012 J	<1.6 J
Benzene	89	44	<0.0066 [<0.0067]	<0.0066	0.050	0.034	<0.013	<0.014	<0.015 J	25
Carbon Disulfide	- -	- -	<0.0066 [<0.0067]	<0.0066	<0.013	<0.013	<0.013	<0.014	<0.015	<1.6
Cyclohexane	- -	- -	<0.0066 [<0.0067]	<0.0066	<0.013	<0.013	<0.013	<0.014	<0.015 J	<1.6
Ethylbenzene	780	390	<0.0066 [<0.0067]	<0.0066	0.013	0.062	<0.013	<0.014	<0.015 J	<1.6
Isopropylbenzene	- -	- -	<0.0066 [<0.0067]	<0.0066	<0.013	<0.013	<0.013	<0.014	<0.015 J	<1.6
Methyl Acetate	- -	- -	<0.0066 [<0.0067]	<0.0066	<0.013	<0.013	<0.013	<0.014	<0.015 J	<1.6 J
Methylcyclohexane	- -	- -	<0.0066 [<0.0067]	<0.0066	<0.013	<0.013	<0.013	<0.014	<0.015 J	<1.6
Methylene Chloride	1,000	500	<0.0066 [<0.0067]	<0.0066	<0.013	<13	<0.013	<0.014	<0.015	<1.6 J
Methyl-tert-butyl ether	1,000	500	<0.0066 [<0.0067]	<0.0066	<0.013	<0.013	<0.013	<0.014	<0.015	<1.6
Styrene	- -	- -	<0.0066 [<0.0067]	<0.0066 J	<0.013	0.0040 J	<0.013	<0.014	<0.015 J	<1.6
Toluene	1,000	500	<0.0066 [<0.0067]	<0.0066	0.014	0.045	<0.013	<0.014	<0.015 J	<1.6
Xylene (total)	1,000	500	<0.020 [<0.020]	<0.020	0.026	0.086	<0.013	<0.014	<0.015 J	<1.6

See notes on page 8.

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SB-4		SB-5		SB-6		SB-7	
Sample Depth(Feet): Date Collected:	Industrial (Bold)	Commercial (Shaded)	14 - 16 06/08/04	26 - 27.5 06/08/04	14 - 15.8 06/22/04	16 - 17.3 06/22/04	14.3 - 15.7 06/16/04	20 - 21 06/16/04	14 - 16 06/10/04	35.2 - 37.2 06/11/04
1,1-Dichloroethane	480	240	<0.014	<0.011 J	<0.012	<0.013	<0.013	<1.8 [<1.6]	<0.013	<0.012 J
2-Butanone	1,000	500	<0.014	<0.011 J	<0.012	<0.013	<0.013 J	<1.8 J [<1.6 J]	<0.013	<0.012 J
Acetone	1,000	500	0.010 J	0.0050 J	0.0050 J	0.0040 J	<0.013 J	<1.8 J [<1.6 J]	<0.013	0.0050 J
Benzene	89	44	<0.014	<0.011 J	<0.012	<0.013	1.0 DJ	0.43 J [3.1 J]	<0.013	<0.012 J
Carbon Disulfide	- -	- -	<0.014	<0.011 J	<0.012	<0.013	<0.013	<1.8 [<1.6]	<0.013	<0.012 J
Cyclohexane	- -	- -	<0.014	<0.011 J	<0.012	<0.013	0.0040 J	<1.8 [<1.6]	<0.013	<0.012 J
Ethylbenzene	780	390	<0.014	R	<0.012	<0.013	0.78 DJ	0.61 J [1.4 J]	<0.013	<0.012 J
Isopropylbenzene	- -	- -	<0.014	R	<0.012	<0.013	<0.013	0.32 J [<1.6]	<0.013	<0.012 J
Methyl Acetate	- -	- -	<0.014	<0.011 J	<0.012	<0.013	<0.013 J	<1.8 J [<1.6 J]	<0.013	<0.012 J
Methylcyclohexane	- -	- -	<0.014	<0.011 J	<0.012	<0.013	<0.013	<1.8 [<1.6]	<0.013	<0.012 J
Methylene Chloride	1,000	500	<0.014	0.0040 J	<0.012	<0.013	<0.013	<1.8 J [<1.6 J]	<0.013	0.0040 J
Methyl-tert-butyl ether	1,000	500	<0.014	<0.011 J	<0.012	<0.013	<0.013	<1.8 [<1.6 J]	<0.013	<0.012 J
Styrene	- -	- -	<0.014	R	<0.012	<0.013	1.6 DJ	2.0 [3.4 J]	<0.013	<0.012 J
Toluene	1,000	500	<0.014	R	<0.012	<0.013	2.0 D	4.8 [8.7]	<0.013	<0.012 J
Xylene (total)	1,000	500	<0.014	R	<0.012	<0.013	12 D	8.4 [16]	<0.013	<0.012 J

See notes on page 8.

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SB-8		SB-9		SB-10		SB-11	
Sample Depth(Feet):	Industrial	Commercial	8 - 9.9	25 - 26.6	4 - 6.5	10.8 - 13.1	8 - 9.5	28 - 32	6 - 10	16 - 20
Date Collected:	(Bold)	(Shaded)	06/16/04	06/16/04	06/10/04	06/10/04	06/24/04	06/24/04	05/11/05	05/11/05
1,1-Dichloroethane	480	240	<0.013	<0.014	<0.012	<0.012	<0.013	<0.012 J	<0.011 J	<1.5 J [<1.6 J]
2-Butanone	1,000	500	<0.013 J	0.0050 J	<0.012	0.0070 J	0.0040 J	0.0080 J	<0.011	<1.5 [<1.6]
Acetone	1,000	500	<0.013 J	0.025 J	<0.012	0.069	0.0090 J	0.035 J	<0.012	<1.5 J [<1.6 J]
Benzene	89	44	<0.013	0.033 J	0.0030 J	0.0040 J	<0.013	24 D	<0.011	11 J [59 DJ]
Carbon Disulfide	- -	- -	<0.013	<0.014	<0.012	<0.012	<0.013	<0.012 J	<0.011 J	<1.5 J [<1.6 J]
Cyclohexane	- -	- -	<0.013	<0.014	<0.012	<0.012	<0.013	<0.012 J	<0.011	<1.5 [<1.6]
Ethylbenzene	780	390	<0.013	<0.014	<0.012	<0.012	<0.013	1.3 DJ	<0.011	<1.5 [<1.6]
Isopropylbenzene	- -	- -	<0.013	<0.014	0.0020 J	<0.012	<0.013	0.0020 J	<0.011	<1.5 [<1.6]
Methyl Acetate	- -	- -	<0.013 J	<0.014 J	<0.012	<0.012	<0.013	<0.012 J	<0.011 J	<1.5 J [<1.6 J]
Methylcyclohexane	- -	- -	<0.013	<0.014	<0.012	<0.012	<0.013	<0.012 J	<0.011	<1.5 [<1.6]
Methylene Chloride	1,000	500	<0.013	<0.014	0.0030 J	0.0030 J	<0.013	<0.012 J	<0.011 J	<1.5 J [<1.6 J]
Methyl-tert-butyl ether	1,000	500	<0.013	<0.014	<0.012	<0.012	<0.013	<0.012 J	<0.011	<1.5 J [<1.6 J]
Styrene	- -	- -	<0.013	<0.014	0.0020 J	<0.012	<0.013	0.098 J	<0.011	<1.5 [<1.6]
Toluene	1,000	500	<0.013	<0.014	0.0030 J	0.0030 J	<0.013	12 D	<0.011	3.1 [2.6]
Xylene (total)	1,000	500	<0.013	<0.014	0.0040 J	<0.012	<0.013	0.43 J	0.0080 J	<1.5 [<1.6]

See notes on page 8.

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SB-12		SB-13		TP-2
Sample Depth(Feet):	Industrial	Commercial	2 - 4	12 - 14	2 - 4	16 - 18	3 - 3.5
Date Collected:	(Bold)	(Shaded)	05/17/05	05/17/05	05/17/05	05/17/05	06/25/04
1,1-Dichloroethane	480	240	<0.012	<0.013	<0.012	<0.013	<0.012
2-Butanone	1,000	500	<0.012 J	<0.013 J	<0.012 J	<0.013 J	<0.012 J
Acetone	1,000	500	<0.012 J	<0.014 J	<0.013 J	<0.013 J	0.0090 J
Benzene	89	44	<0.012	<0.013	<0.012	<0.013	<0.012
Carbon Disulfide	- -	- -	<0.012	<0.013	<0.012	<0.013	<0.012
Cyclohexane	- -	- -	<0.012	<0.013	<0.012	<0.013	<0.012
Ethylbenzene	780	390	<0.012	<0.013	<0.012	<0.013	<0.012
Isopropylbenzene	- -	- -	<0.012	<0.013	<0.012	<0.013	<0.012
Methyl Acetate	- -	- -	<0.012 J	<0.013 J	<0.012 J	<0.013 J	<0.012 J
Methylcyclohexane	- -	- -	<0.012	<0.013	<0.012	<0.013	<0.012
Methylene Chloride	1,000	500	<0.012	<0.013	<0.012	<0.013	0.0040 J
Methyl-tert-butyl ether	1,000	500	<0.012	<0.013	<0.012	<0.013	<0.012
Styrene	- -	- -	<0.012	<0.013	<0.012	<0.013	<0.012
Toluene	1,000	500	0.014	0.037	0.015	0.030	<0.012
Xylene (total)	1,000	500	<0.012	<0.013	<0.012	<0.013	<0.012

See notes on page 8.

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED VOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by ARCADIS of New York, Inc. on the dates indicated.
2. VOCs = Volatile Organic Compounds.
3. Samples were analyzed by CompuChem located in Cary, North Carolina for VOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8260.
4. Only those constituents detected in one or more samples are summarized.
5. Concentrations reported in dry weight parts per million (ppm), which is equivalent to milligrams per kilogram (mg/kg).
6. Field duplicate sample results are presented in brackets.
7. Data qualifiers are defined as follows:
   - < = Constituent not detected at a concentration above the reported detection limit.
   - D = Concentration is based on a diluted sample analysis.
   - J = The compound was positively identified; however the associated numerical value is an estimated concentration only.
   - R = The sample results are rejected.
8. 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) are from the Draft and Proposed New Superfund/Brownfield Regulations released for public comment on July 5, 2006.
9. Bold font indicates that the result exceeds the 6 NYCRR Part 375 Industrial Use SCO.
10. Shading indicates that the result exceeds the 6 NYCRR Part 375 Commercial Use SCO.
11. - - = No 6 NYCRR Part 375 SCO listed.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9
Sample Depth(Feet):	Industrial	Commercial	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Date Collected:	(Bold)	(Shaded)	06/10/04	06/24/04	06/24/04	06/25/04	06/25/04	06/24/04	06/25/04	06/25/04	06/25/04
1,1'-Biphenyl	- -	- -	<0.37	<0.35	<1.1	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
2-Methylnaphthalene	- -	- -	<0.37	0.10 J	0.27 J	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
Acenaphthene	1,000	500	<0.37	0.14 J	0.87 J	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
Acenaphthylene	1,000	500	<0.37	<0.35	0.23 J	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
Acetophenone	- -	- -	<0.37	<0.35	<1.1	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
Anthracene	1,000	500	<0.37	0.34 J	2.6	0.29 J	<0.35	<1.8	<0.36	<0.35	<0.35
Benzo(a)anthracene	11	5.6	0.13 J	1.1	9.6	0.77	<0.35	0.65 J	<0.36	<0.35	<0.35
Benzo(a)pyrene	1.1	1	0.19 J	**1.5**	**13**	0.71	<0.35	0.88 J	<0.36	<0.35	<0.35 J
Benzo(b)fluoranthene	11	5.6	<0.37	1.1	**12**	0.59	<0.35	0.71 J	<0.36	<0.35	<0.35
Benzo(g,h,i)perylene	1,000	500	0.24 J	0.76 J	6.4	0.43 J	<0.35 J	0.67 J	<0.36 J	<0.35 J	<0.35 J
Benzo(k)fluoranthene	110	56	0.24 J	1.2 J	8.6	0.62 J	<0.35 J	0.73 J	<0.36 J	<0.35 J	<0.35 J
Bis(2-ethylhexyl) phthalate	- -	- -	0.12 J	0.21 J	<1.1	0.32 J	<0.35	1.7 J	<0.36	<0.35	<0.35
Butylbenzyl phthalate	- -	- -	0.49	<0.35	1.1	<0.35	<0.35	19	<0.36	<0.35	<0.35
Carbazole	- -	- -	<0.37 J	0.16 J	1.3 J	<0.35 J	<0.35 J	<1.8 J	<0.36 J	<0.35 J	<0.35 J
Chrysene	110	56	0.18 J	1.2	10	0.75	<0.35	0.75 J	<0.36	<0.35	<0.35
Dibenzo(a,h)anthracene	1.1	0.56	<0.37	0.34 J	**3.4**	0.20 J	<0.35 J	<1.8	<0.36 J	<0.35	<0.35 J
Dibenzofuran	1,000	350	<0.37	0.082 J	0.46 J	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
Di-n-butyl phthalate	- -	- -	<0.37	<0.35	<1.1	<0.35	<0.35	3.2	<0.36	<0.35	<0.35
Di-n-octyl phthalate	- -	- -	0.10 J	<0.35 J	<1.1	<0.35 J	<0.35 J	<1.8	<0.36 J	<0.35 J	<0.35 J
Fluoranthene	1,000	500	0.26 J	1.8	12	1.6	<0.35	0.91 J	<0.36	<0.35	<0.35
Fluorene	1,000	500	<0.37 J	0.13 J	0.69 J	0.094 J	<0.35	<1.8 J	<0.36	<0.35	<0.35
Hexachlorobenzene	12	6	<0.37 J	<0.35 J	<1.1 J	<0.35 J	<0.35 J	1.5 J	<0.36 J	<0.35 J	<0.35 J
Indeno(1,2,3-cd)pyrene	11	5.6	0.16 J	1.0 J	8.9	0.53 J	<0.35 J	0.70 J	<0.36 J	<0.35 J	<0.35 J
Naphthalene	1,000	500	<0.37	0.27 J	1.7	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
Phenanthrene	1,000	500	0.11 J	1.2	7.2	1.0	<0.35	0.49 J	<0.36	<0.35	<0.35
Phenol	1,000	500	<0.37	<0.35	<1.1	<0.35	<0.35	<1.8	<0.36	<0.35	<0.35
Pyrene	1,000	500	0.17 J	1.6	10	1.3	<0.35	0.83 J	<0.36	<0.35	<0.35

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SS-10	MW-1		MW-2		MW-3A	
Sample Depth(Feet): Date Collected:	Industrial (Bold)	Commercial (Shaded)	0.1 - 0.2 06/30/04	28 - 30 06/15/04	36 - 38 06/15/04	4.7 - 5.7 06/18/04	32 - 34 06/18/04	14 - 16 06/25/04	24 - 26 06/25/04
1,1'-Biphenyl	- -	- -	<0.35	NA	<0.43	<0.43	NA	NA	NA
2-Methylnaphthalene	- -	- -	0.13 J	NA	<0.43	<0.43	NA	NA	NA
Acenaphthene	1,000	500	1.1	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Acenaphthylene	1,000	500	0.14 J	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Acetophenone	- -	- -	<0.35	NA	<0.43	0.12 J	NA	NA	NA
Anthracene	1,000	500	2.1	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Benzo(a)anthracene	11	5.6	9.9 D	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Benzo(a)pyrene	1.1	1	**9.9 D**	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Benzo(b)fluoranthene	11	5.6	9.3 D	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Benzo(g,h,i)perylene	1,000	500	5.3 J	<0.46	<0.43	<0.43	<0.45	<0.48 J	<0.41 J
Benzo(k)fluoranthene	110	56	3.9	<0.46	<0.43	<0.43 J	<0.45	<0.48 J	<0.41 J
Bis(2-ethylhexyl) phthalate	- -	- -	<0.35	NA	<0.43	0.15 J	NA	NA	NA
Butylbenzyl phthalate	- -	- -	<0.35	NA	<0.43	<0.43	NA	NA	NA
Carbazole	- -	- -	2.2 J	NA	<0.43 J	<0.43 J	NA	NA	NA
Chrysene	110	56	12 D	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Dibenzo(a,h)anthracene	1.1	0.56	**2.3**	<0.46	<0.43	<0.43	<0.45	<0.48 J	<0.41 J
Dibenzofuran	1,000	350	0.40	NA	<0.43	<0.43	NA	NA	NA
Di-n-butyl phthalate	- -	- -	<0.35	NA	<0.43	<0.43	NA	NA	NA
Di-n-octyl phthalate	- -	- -	<0.35	NA	<0.43	<0.43	NA	NA	NA
Fluoranthene	1,000	500	21 D	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Fluorene	1,000	500	1.1 J	<0.46 J	<0.43 J	<0.43 J	<0.45 J	<0.48	<0.41
Hexachlorobenzene	12	6	<0.35 J	NA	<0.43 J	<0.43 J	NA	NA	NA
Indeno(1,2,3-cd)pyrene	11	5.6	7.2 D	<0.46	<0.43	<0.43	<0.45	<0.48 J	<0.41 J
Naphthalene	1,000	500	0.22 J	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Phenanthrene	1,000	500	13 D	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41
Phenol	1,000	500	<0.35	NA	<0.43	<0.43	NA	NA	NA
Pyrene	1,000	500	18 D	<0.46	<0.43	<0.43	<0.45	<0.48	<0.41

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-4		MW-5		MW-6		MW-7	
Sample Depth(Feet):	Industrial	Commercial	8 - 10	28 - 30	16 - 17.6	30 - 32	8 - 9.4	14.6 - 15.3	14 - 16	24 - 26
Date Collected:	(Bold)	(Shaded)	06/22/04	06/22/04	06/09/04	06/09/04	06/23/04	06/23/04	06/14/04	06/14/04
1,1'-Biphenyl	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41
2-Methylnaphthalene	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41
Acenaphthene	1,000	500	<0.40	<0.35	0.13 J	<0.44 [<0.41]	29	0.096 J	<0.41	<0.41
Acenaphthylene	1,000	500	<0.40	<0.35	<0.41	<0.44 [<0.41]	12	<0.40	<0.41	<0.41
Acetophenone	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41
Anthracene	1,000	500	<0.40	<0.35	0.26 J	<0.44 [<0.41]	39 D	0.33 J	<0.41	<0.41
Benzo(a)anthracene	11	5.6	<0.40	<0.35	0.33 J	<0.44 [<0.41]	**50 D**	1.2	<0.41	<0.41
Benzo(a)pyrene	1.1	1	<0.40	<0.35	0.30 J	<0.44 [<0.41]	**43 D**	0.66	<0.41	<0.41
Benzo(b)fluoranthene	11	5.6	<0.40	<0.35	0.24 J	<0.44 [<0.41]	**34 D**	0.70	<0.41	<0.41
Benzo(g,h,i)perylene	1,000	500	<0.40	<0.35	0.15 J	<0.44 J [<0.41 J]	43 J	0.27 J	<0.41	<0.41
Benzo(k)fluoranthene	110	56	<0.40	<0.35	0.25 J	<0.44 [<0.41]	52	0.71	<0.41	<0.41
Bis(2-ethylhexyl) phthalate	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41
Butylbenzyl phthalate	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41
Carbazole	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41 J
Chrysene	110	56	<0.40	<0.35	0.34 J	<0.44 [<0.41]	50 D	1.2	<0.41	<0.41
Dibenzo(a,h)anthracene	1.1	0.56	<0.40	<0.35	<0.41	<0.44 [<0.41]	**16 J**	0.19 J	<0.41	<0.41
Dibenzofuran	1,000	350	NA	NA	NA	NA	NA	NA	NA	<0.41
Di-n-butyl phthalate	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41
Di-n-octyl phthalate	- -	- -	NA	NA	NA	NA	NA	NA	NA	<0.41
Fluoranthene	1,000	500	0.10 J	<0.35	0.86	<0.44 [<0.41]	120 D	1.5	<0.41	<0.41
Fluorene	1,000	500	<0.40 J	<0.35 J	0.17 J	<0.44 J [<0.41 J]	68 J	0.19 J	<0.41 J	<0.41 J
Hexachlorobenzene	12	6	NA	NA	NA	NA	NA	NA	NA	<0.41 J
Indeno(1,2,3-cd)pyrene	11	5.6	<0.40	<0.35	0.16 J	<0.44 J [<0.41 J]	**57 J**	0.36 J	<0.41	<0.41
Naphthalene	1,000	500	<0.40	<0.35	0.089 J	5.6 [2.2]	55	0.093 J	<0.41	<0.41
Phenanthrene	1,000	500	<0.40	<0.35	1.1	<0.44 [<0.41]	130 D	1.2	<0.41	<0.41
Phenol	1,000	500	NA	NA	NA	NA	NA	NA	NA	<0.41
Pyrene	1,000	500	0.10 J	<0.35	0.77	<0.44 [<0.41]	98 D	0.75	<0.41	<0.41

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-8		MW-9	MW-10		MW-11	MW-12	MW-13	
Sample Depth(Feet):	Industrial	Commercial	11.3 - 13.1	18 - 20	10 - 12	10 - 12	12 - 14	14 - 16	5 - 7	8 - 10	14 - 16
Date Collected:	(Bold)	(Shaded)	06/23/04	06/22/04	05/12/05	05/11/05	05/11/05	05/12/05	05/16/05	09/06/05	09/06/05
1,1'-Biphenyl	- -	- -	<0.43	NA	0.13 J	<0.41	0.20 J	<0.42	<0.43	0.032 J	<0.35
2-Methylnaphthalene	- -	- -	<0.43	NA	0.16 J	<0.41	1.1	0.13 J	<0.43	<0.45	<0.35
Acenaphthene	1,000	500	<0.43	<0.39	<0.42	<0.41	0.19 J	0.13 J	<0.43	<0.45	<0.35
Acenaphthylene	1,000	500	<0.43	<0.39	<0.42	<0.41	1.1	<0.42	<0.43	<0.45	<0.35
Acetophenone	- -	- -	<0.43	NA	<0.42	<0.41	<0.41	<0.42	<0.43	<0.45	<0.35
Anthracene	1,000	500	<0.43	<0.39	0.29 J	0.086 J	1.1	0.46	<0.43	0.042 J	0.027 J
Benzo(a)anthracene	11	5.6	<0.43	<0.39	0.32 J	<0.41	0.76	0.41 J	<0.43	0.19 J	0.15 J
Benzo(a)pyrene	1.1	1	<0.43	<0.39	0.21 J	<0.41	0.64	0.32 J	<0.43	0.20 J	0.15 J
Benzo(b)fluoranthene	11	5.6	<0.43	<0.39	0.15 J	<0.41 J	0.41 J	0.22 J	<0.43 J	0.20 J	0.19 J
Benzo(g,h,i)perylene	1,000	500	<0.43	<0.39	0.099 J	<0.41 J	0.40 J	0.14 J	<0.43	0.13 J	0.10 J
Benzo(k)fluoranthene	110	56	<0.43	<0.39	0.18 J	<0.41	0.63	0.25 J	<0.43	0.22 J	0.14 J
Bis(2-ethylhexyl) phthalate	- -	- -	<0.43	NA	<0.42	<0.41	0.11 J	0.17 J	<0.43	0.052 J	<0.35
Butylbenzyl phthalate	- -	- -	<0.43	NA	<0.42	<0.41	<0.41	<0.42	<0.43	<0.45	<0.35
Carbazole	- -	- -	<0.43 J	NA	<0.42	<0.41	0.53	0.27 J	<0.43	0.059 J	0.035 J
Chrysene	110	56	<0.43	<0.39	0.30 J	<0.41	0.72	0.38 J	<0.43	0.25 J	0.20 J
Dibenzo(a,h)anthracene	1.1	0.56	<0.43	<0.39	<0.42	<0.41	0.13 J	<0.42	<0.43	0.039 J	0.030 J
Dibenzofuran	1,000	350	<0.43	NA	0.54	<0.41	0.75	0.12 J	<0.43	<0.45	<0.35
Di-n-butyl phthalate	- -	- -	<0.43	NA	<0.42	<0.41	<0.41	<0.42	<0.43	<0.45	<0.35
Di-n-octyl phthalate	- -	- -	<0.43	NA	<0.42	<0.41	<0.41	<0.42	<0.43	<0.45	<0.35
Fluoranthene	1,000	500	<0.43	<0.39	0.75	0.20 J	2.4	0.70	<0.43	0.42 J	0.35 J
Fluorene	1,000	500	<0.43 J	<0.39 J	0.16 J	<0.41	1.0	0.27 J	<0.43	<0.45	<0.35
Hexachlorobenzene	12	6	<0.43 J	NA	<0.42	<0.41	<0.41	<0.42	<0.43	<0.45	<0.35
Indeno(1,2,3-cd)pyrene	11	5.6	<0.43	<0.39	0.090 J	<0.41	0.39 J	0.15 J	<0.43	0.12 J	0.10 J
Naphthalene	1,000	500	0.21 J	<0.39	0.51	0.13 J	2.9	<0.42	<0.43	<0.45	<0.35
Phenanthrene	1,000	500	<0.43	<0.39	2.1	0.29 J	3.7	1.6	<0.43	0.20 J	0.14 J
Phenol	1,000	500	0.47	NA	<0.42	<0.41	<0.41	<0.42	<0.43	<0.45	<0.35
Pyrene	1,000	500	<0.43	<0.39	0.57	0.15 J	1.7	0.63	<0.43	0.36 J	0.29 J

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-14		SB-1		SB-2		SB-3	
Sample Depth(Feet):	Industrial	Commercial	14 - 16	20 - 22	8 - 11	14.5 - 15.4	8 - 9	12 - 15.2	10 - 12	22 - 24
Date Collected:	(Bold)	(Shaded)	09/09/05	09/09/05	06/11/04	06/11/04	06/21/04	06/21/04	06/17/04	06/17/04
1,1'-Biphenyl	- -	- -	<0.43 [<0.44]	<0.43	NA	<0.41	NA	NA	<0.49	NA
2-Methylnaphthalene	- -	- -	<0.43 [<0.44]	<0.43	NA	<0.41	NA	NA	<0.49	NA
Acenaphthene	1,000	500	<0.43 [<0.44]	<0.43	0.16 J	<0.41	<0.44	0.23 J	<0.49	<0.40
Acenaphthylene	1,000	500	<0.43 [<0.44]	<0.43 J	<0.43	<0.41	<0.44	0.49	<0.49	<0.40
Acetophenone	- -	- -	<0.43 [<0.44]	<0.43	NA	<0.41	NA	NA	<0.49	NA
Anthracene	1,000	500	<0.43 [<0.44]	<0.43	0.12 J	0.23 J	<0.44	1.6	<0.49	<0.40
Benzo(a)anthracene	11	5.6	<0.43 [<0.44]	<0.43	0.41 J	0.69	<0.44	2.1	<0.49	<0.40
Benzo(a)pyrene	1.1	1	<0.43 [<0.44]	<0.43	0.30 J	1.0	<0.44	**2.1**	<0.49	<0.40
Benzo(b)fluoranthene	11	5.6	<0.43 J [<0.44 J]	<0.43 J	0.26 J	0.68	<0.44	1.4	<0.49	<0.40
Benzo(g,h,i)perylene	1,000	500	<0.43 J [<0.44 J]	<0.43 J	0.12 J	0.51 J	<0.44	1.0	<0.49	<0.40
Benzo(k)fluoranthene	110	56	<0.43 [<0.44]	<0.43	0.26 J	0.76	<0.44	1.5	<0.49	<0.40
Bis(2-ethylhexyl) phthalate	- -	- -	0.34 J [1.2]	0.61	NA	<0.41	NA	NA	<0.49	NA
Butylbenzyl phthalate	- -	- -	<0.43 [<0.44]	<0.43	NA	<0.41	NA	NA	<0.49	NA
Carbazole	- -	- -	<0.43 [<0.44]	<0.43	NA	0.092 J	NA	NA	<0.49 J	NA
Chrysene	110	56	<0.43 [<0.44]	<0.43	0.47	0.72	<0.44	2.1	<0.49	<0.40
Dibenzo(a,h)anthracene	1.1	0.56	<0.43 J [<0.44 J]	<0.43 J	<0.43	0.14 J	<0.44	0.29 J	<0.49	<0.40
Dibenzofuran	1,000	350	<0.43 [<0.44]	<0.43	NA	<0.41	NA	NA	<0.49	NA
Di-n-butyl phthalate	- -	- -	<0.43 [<0.44]	<0.43	NA	<0.41	NA	NA	<0.49	NA
Di-n-octyl phthalate	- -	- -	<0.43 [<0.44]	<0.43	NA	<0.41 J	NA	NA	<0.49	NA
Fluoranthene	1,000	500	<0.43 [<0.44]	<0.43	1.1	1.2	<0.44	4.0	<0.49	<0.40
Fluorene	1,000	500	<0.43 [<0.44]	<0.43	0.16 J	<0.41 J	<0.44 J	0.60 J	<0.49 J	<0.40 J
Hexachlorobenzene	12	6	<0.43 [<0.44]	<0.43	NA	<0.41 J	NA	NA	<0.49 J	NA
Indeno(1,2,3-cd)pyrene	11	5.6	<0.43 [<0.44]	<0.43	0.14 J	0.60 J	<0.44	1.3	<0.49	<0.40
Naphthalene	1,000	500	<0.43 [<0.44]	<0.43	0.15 J	0.31 J	<0.44	0.17 J	<0.49	<0.40
Phenanthrene	1,000	500	<0.43 [<0.44]	<0.43	1.0	0.89	<0.44	3.3	<0.49	<0.40
Phenol	1,000	500	<0.43 [<0.44]	<0.43	NA	<0.41	NA	NA	<0.49	NA
Pyrene	1,000	500	<0.43 [<0.44]	<0.43	0.96	1.3	<0.44	3.6	<0.49	<0.40

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SB-4		SB-5		SB-6		SB-7	
Sample Depth(Feet):	Industrial	Commercial	14 - 16	26 - 27.5	14 - 15.8	16 - 17.3	14.3 - 15.7	20 - 21	14 - 16	35.2 - 37.2
Date Collected:	(Bold)	(Shaded)	06/08/04	06/08/04	06/22/04	06/22/04	06/16/04	06/16/04	06/10/04	06/11/04
1,1'-Biphenyl	- -	- -	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
2-Methylnaphthalene	- -	- -	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Acenaphthene	1,000	500	<0.46	<0.38	<0.40	<0.41	<0.43	<0.45 [<0.41]	<0.43	<0.41
Acenaphthylene	1,000	500	<0.46	<0.38	0.14 J	<0.41	<0.43	<0.45 [<0.41]	<0.43	<0.41
Acetophenone	- -	- -	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Anthracene	1,000	500	<0.46	<0.38	<0.40	<0.41	<0.43	<0.45 [<0.41]	<0.43	<0.41
Benzo(a)anthracene	11	5.6	<0.46	<0.38	0.56	<0.41	<0.43	<0.45 [<0.41]	0.14 J	<0.41
Benzo(a)pyrene	1.1	1	<0.46	<0.38	0.35 J	<0.41	<0.43	<0.45 [<0.41]	0.18 J	<0.41
Benzo(b)fluoranthene	11	5.6	<0.46	<0.38	0.19 J	<0.41	<0.43	<0.45 [<0.41]	0.12 J	<0.41
Benzo(g,h,i)perylene	1,000	500	<0.46 J	<0.38 J	<0.40	<0.41	<0.43	<0.45 [<0.41]	0.12 J	<0.41 J
Benzo(k)fluoranthene	110	56	<0.46	<0.38	0.32 J	<0.41	<0.43	<0.45 [<0.41]	0.16 J	<0.41
Bis(2-ethylhexyl) phthalate	- -	- -	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Butylbenzyl phthalate	- -	- -	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Carbazole	- -	- -	<0.46 J	NA	NA	NA	NA	<0.45 J [<0.41 J]	NA	NA
Chrysene	110	56	<0.46	<0.38	0.54	<0.41	<0.43	<0.45 [<0.41]	0.15 J	<0.41
Dibenzo(a,h)anthracene	1.1	0.56	<0.46	<0.38	<0.40	<0.41	<0.43	<0.45 [<0.41]	<0.43	<0.41
Dibenzofuran	1,000	350	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Di-n-butyl phthalate	- -	- -	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Di-n-octyl phthalate	- -	- -	<0.46 J	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Fluoranthene	1,000	500	<0.46	<0.38	0.58	<0.41	<0.43	<0.45 [<0.41]	0.23 J	<0.41
Fluorene	1,000	500	<0.46 J	<0.38 J	<0.40 J	<0.41 J	<0.43 J	<0.45 J [<0.41 J]	<0.43 J	<0.41 J
Hexachlorobenzene	12	6	<0.46 J	NA	NA	NA	NA	<0.45 J [<0.41 J]	NA	NA
Indeno(1,2,3-cd)pyrene	11	5.6	<0.46 J	<0.38 J	0.085 J	<0.41	<0.43	<0.45 [<0.41]	0.11 J	<0.41 J
Naphthalene	1,000	500	<0.46	<0.38	<0.40	<0.41	0.74	0.87 [0.96]	<0.43	<0.41
Phenanthrene	1,000	500	<0.46	<0.38	<0.40	<0.41	<0.43	<0.45 [<0.41]	0.13 J	<0.41
Phenol	1,000	500	<0.46	NA	NA	NA	NA	<0.45 [<0.41]	NA	NA
Pyrene	1,000	500	<0.46	<0.38	0.57	<0.41	<0.43	<0.45 [<0.41]	0.24 J	<0.41

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SB-8		SB-9		SB-10		SB-11	
Sample Depth(Feet):	Industrial	Commercial	8 - 9.9	25 - 26.6	4 - 6.5	10.8 - 13.1	8 - 9.5	28 - 32	6 - 10	16 - 20
Date Collected:	(Bold)	(Shaded)	06/16/04	06/16/04	06/10/04	06/10/04	06/24/04	06/24/04	05/11/05	05/11/05
1,1'-Biphenyl	- -	- -	NA	NA	NA	<0.58	NA	<0.39	0.11 J	<0.39 [<0.40]
2-Methylnaphthalene	- -	- -	NA	NA	NA	<0.58	NA	<0.39	0.52	<0.39 [<0.40]
Acenaphthene	1,000	500	<0.44	0.35 J	<0.38	<0.58	<0.43	<0.39	0.10 J	<0.39 [<0.40]
Acenaphthylene	1,000	500	<0.44	<1.3	<0.38	<0.58	<0.43	<0.39	0.64	<0.39 [<0.40]
Acetophenone	- -	- -	NA	NA	NA	<0.58	NA	<0.39	<0.36	<0.39 [<0.40]
Anthracene	1,000	500	<0.44	0.95 J	<0.38	<0.58	<0.43	<0.39	0.76	<0.39 [<0.40]
Benzo(a)anthracene	11	5.6	<0.44	3.8	0.11 J	<0.58	<0.43	<0.39	0.66	0.097 J [<0.40]
Benzo(a)pyrene	1.1	1	<0.44	**5.5**	0.12 J	<0.58	<0.43	<0.39	0.58	0.11 J [<0.40]
Benzo(b)fluoranthene	11	5.6	<0.44	3.6	0.099 J	<0.58	<0.43	<0.39	0.42 J	0.088 J [<0.40 J]
Benzo(g,h,i)perylene	1,000	500	<0.44	2.2	<0.38 J	<0.58 J	<0.43	<0.39	0.39 J	0.11 J [<0.40 J]
Benzo(k)fluoranthene	110	56	<0.44	4.0	0.10 J	<0.58	<0.43	<0.39	0.58	0.099 J [<0.40]
Bis(2-ethylhexyl) phthalate	- -	- -	NA	NA	NA	<0.58	NA	<0.39	0.29 J	0.13 J [<0.40]
Butylbenzyl phthalate	- -	- -	NA	NA	NA	<0.58	NA	<0.39	<0.36	<0.39 [<0.40]
Carbazole	- -	- -	NA	NA	NA	<0.58 J	NA	<0.39 J	0.35 J	<0.39 [<0.40]
Chrysene	110	56	<0.44	3.7	0.11 J	0.16 J	<0.43	<0.39	0.64	0.12 J [<0.40]
Dibenzo(a,h)anthracene	1.1	0.56	<0.44	0.95 J	<0.38	<0.58	<0.43	<0.39	0.12 J	<0.39 [<0.40]
Dibenzofuran	1,000	350	NA	NA	NA	<0.58	NA	<0.39	0.45	<0.39 [<0.40]
Di-n-butyl phthalate	- -	- -	NA	NA	NA	<0.58	NA	<0.39	<0.36	<0.39 [<0.40]
Di-n-octyl phthalate	- -	- -	NA	NA	NA	<0.58 J	NA	<0.39	<0.36	<0.39 [0.081 J]
Fluoranthene	1,000	500	<0.44	4.0	0.19 J	0.26 J	<0.43	<0.39	1.8	0.31 J [0.12 J]
Fluorene	1,000	500	<0.44 J	0.42 J	<0.38 J	<0.58 J	<0.43 J	<0.39 J	0.63	<0.39 [<0.40]
Hexachlorobenzene	12	6	NA	NA	NA	<0.58 J	NA	<0.39 J	<0.36	<0.39 [<0.40]
Indeno(1,2,3-cd)pyrene	11	5.6	<0.44	3.0	<0.38 J	<0.58 J	<0.43	<0.39	0.35 J	<0.39 [<0.40]
Naphthalene	1,000	500	<0.44	2.3	<0.38	<0.58	<0.43	<0.39	1.2	0.36 J [0.30 J]
Phenanthrene	1,000	500	<0.44	2.5	0.11 J	0.21 J	<0.43	<0.39	2.5	0.36 J [0.15 J]
Phenol	1,000	500	NA	NA	NA	<0.58	NA	0.46	<0.36	<0.39 [<0.40]
Pyrene	1,000	500	<0.44	3.1	0.19 J	0.26 J	<0.43	<0.39	1.3	0.31 J [0.13 J]

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SB-12		SB-13		TP-2	
Sample Depth(Feet):	Industrial	Commercial	2 - 4	12 - 14	2 - 4	16 - 18	2 - 2.5	3 - 3.5
Date Collected:	(Bold)	(Shaded)	05/17/05	05/17/05	05/17/05	05/17/05	06/24/04	06/25/04
1,1'-Biphenyl	- -	- -	<0.38	<0.42	<0.41	<0.42	<0.38	NA
2-Methylnaphthalene	- -	- -	<0.38	<0.42	<0.41	<0.42	<0.38	NA
Acenaphthene	1,000	500	<0.38	<0.42	<0.41	<0.42	<0.38	<0.39
Acenaphthylene	1,000	500	<0.38	<0.42	<0.41	<0.42	<0.38	<0.39
Acetophenone	- -	- -	<0.38	<0.42	<0.41	<0.42	<0.38	NA
Anthracene	1,000	500	<0.38	0.10 J	<0.41	<0.42	<0.38	<0.39
Benzo(a)anthracene	11	5.6	<0.38	0.70	<0.41	0.12 J	<0.38	<0.39
Benzo(a)pyrene	1.1	1	<0.38	0.53	<0.41	0.16 J	<0.38	<0.39
Benzo(b)fluoranthene	11	5.6	<0.38 J	0.37 J	<0.41 J	0.12 J	<0.38	<0.39
Benzo(g,h,i)perylene	1,000	500	<0.38	0.25 J	<0.41	0.14 J	<0.38	<0.39 J
Benzo(k)fluoranthene	110	56	<0.38	0.52	<0.41	0.13 J	<0.38	<0.39 J
Bis(2-ethylhexyl) phthalate	- -	- -	<0.38	0.12 J	0.26 J	0.096 J	1.4	NA
Butylbenzyl phthalate	- -	- -	<0.38	<0.42	<0.41	<0.42	<0.38	NA
Carbazole	- -	- -	<0.38	<0.42	<0.41	<0.42	<0.38 J	NA
Chrysene	110	56	<0.38	0.60	<0.41	0.12 J	<0.38	<0.39
Dibenzo(a,h)anthracene	1.1	0.56	<0.38	0.14 J	<0.41	<0.42	<0.38	<0.39 J
Dibenzofuran	1,000	350	<0.38	<0.42	<0.41	<0.42	<0.38	NA
Di-n-butyl phthalate	- -	- -	<0.38	<0.42	<0.41	<0.42	<0.38	NA
Di-n-octyl phthalate	- -	- -	<0.38	<0.42	<0.41	<0.42	<0.38	NA
Fluoranthene	1,000	500	<0.38	0.77	<0.41	0.18 J	0.11 J	<0.39
Fluorene	1,000	500	<0.38	<0.42	<0.41	<0.42	<0.38 J	<0.39
Hexachlorobenzene	12	6	<0.38	<0.42	<0.41	<0.42	<0.38 J	NA
Indeno(1,2,3-cd)pyrene	11	5.6	<0.38	0.27 J	<0.41	0.12 J	<0.38	<0.39 J
Naphthalene	1,000	500	<0.38	<0.42	<0.41	<0.42	<0.38	<0.39
Phenanthrene	1,000	500	<0.38	0.14 J	<0.41	0.14 J	<0.38	<0.39
Phenol	1,000	500	<0.38	<0.42	<0.41	<0.42	<0.38	NA
Pyrene	1,000	500	<0.38	0.82	<0.41	0.18 J	0.099 J	<0.39

See notes on Page 9.

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED SVOCs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by ARCADIS of New York, Inc. on the dates indicated.
2. SVOCs = Semi Volatile Organic Compounds.
3. Samples were analyzed by CompuChem located in Cary, North Carolina for SVOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8270.
4. Only those constituents detected in one or more samples are summarized.
5. Concentrations reported in dry weight parts per million (ppm), which is equivalent to milligrams per kilogram (mg/kg).
6. Field duplicate sample results are presented in brackets.
7. Data qualifiers are defined as follows:
   - < = Constituent not detected at a concentration above the reported detection limit.
   - D = Concentration is based on a diluted sample analysis.
   - J = The compound was positively identified; however the associated numerical value is an estimated concentration only.
8. 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) are from the Draft and Proposed New Superfund/Brownfield Regulations released for public comment on July 5, 2006.
9. Bold font indicates that the result exceeds the 6 NYCRR Part 375 Industrial Use SCO.
10. Shading indicates that the result exceeds the 6 NYCRR Part 375 Commercial Use SCO.
11. - - = No 6 NYCRR Part 375 SCO listed.
12. NA = Not Analyzed.

TABLE 3
SUMMARY OF SOIL ANALYTICAL RESULTS FOR DETECTED PCBs (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SS-4	SS-5	SS-7	SS-8	SS-9	MW-6		MW-7	SB-1	SB-3
Sample Depth(Feet):	Industrial	Commercial	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	8 - 9.4	14.6 - 15.3	14 - 16	8 - 11	10 - 12
Date Collected:	(Bold)	(Shaded)	06/25/04	06/25/04	06/25/04	06/25/04	06/25/04	06/23/04	06/23/04	06/14/04	06/11/04	06/17/04
Total PCBs	25	1	<0.072	<0.071	R	<0.071	<0.072	3.2 J [2.0 J]	<0.082	<0.084	<0.087	<0.099

Notes:

1. Samples were collected by ARCADIS of New York, Inc. (ARCADIS BBL) on the dates indicated
2. PCBs = Polychlorinated Biphenyls.
3. Samples were analyzed by CompuChem located in Cary, North Carolina for PCBs using United States Environmental Protection Agency (USEPA) SW-846 Method 8082
4. Only those constituents detected in one or more samples are summarized
5. Concentrations reported in dry weight parts per million (ppm), which is equivalent to milligrams per kilogram (mg/kg)
6. Field duplicate sample results are presented in brackets.
7. Data qualifiers are defined as follows:
   - < = Constituent not detected at a concentration above the reported detection limit
   - J = The compound was positively identified; however the associated numerical value is an estimated concentration only
   - R = The sample results are rejected.
8. 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) are from the Draft and Proposed New Superfund/Brownfield Regulations released for public comment on July 5, 2006
9. Bold font indicates that the result exceeds the 6 NYCRR Part 375 Industrial Use SCO
10. Shading indicates that the result exceeds the 6 NYCRR Part 375 Commercial Use SCO

TABLE 4
SUMMARY OF SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8
Sample Depth(Feet): Date Collected:	Industrial (Bold)	Commercial (Shaded)	0 - 0.5 06/10/04	0 - 0.5 06/24/04	0 - 0.5 06/24/04	0 - 0.5 06/25/04	0 - 0.5 06/25/04	0 - 0.5 06/24/04	0 - 0.5 06/25/04	0 - 0.5 06/25/04
Aluminum	- -	- -	5,750	7,920 J	9,790 J	9,450 J	9,890 J	8,100 J	10,800 J	10,700 J
Antimony	- -	- -	<10.0 J	1.30 J	1.10 BJ	0.880 BJ	0.930 BJ	6.70 J	1.00 BJ	0.910 BJ
Arsenic	16	16	4.90	5.50 J	7.00 J	5.00 J	5.50 J	11.0 J	5.60 J	7.20 J
Barium	10,000	400	96.9	60.3 J	159 J	75.9 J	66.2 J	450 J	75.9 J	68.1 J
Beryllium	2,700	590	0.350 B	0.370 B	0.540 B	0.420 B	0.430 B	0.430 B	0.510 B	0.460 B
Cadmium	60	9.3	2.70	1.00	1.00	0.490 B	1.20	9.90	5.40	0.760
Calcium	- -	- -	73,000	19,500 J	28,000 J	22,800 J	9,730 J	14,500 J	4,030 J	11,500 J
Chromium	- -	- -	20.1 J	14.3	15.3	12.6	12.8	75.7	36.7	15.6
Cobalt	- -	- -	5.80	8.00 J	8.00 J	6.90 J	9.00 J	14.1 J	10.0 J	10.3 J
Copper	10,000	270	93.5	45.0 J	42.2 J	36.8 J	28.3 J	288 J	35.2 J	36.7 J
Iron	- -	- -	23,400	25,600 J	23,500 J	20,200 J	23,400 J	84,900 J	25,600 J	26,400 J
Lead	3,900	1,000	187	145 J	139 J	44.9 J	18.2 J	1,130 J	19.1 J	19.5 J
Magnesium	- -	- -	9,520	5,410 J	5,560 J	6,860 J	5,830 J	4,990 J	5,190 J	6,150 J
Manganese	10,000	10,000	272	430 J	685 J	476 J	548 J	693 J	367 J	722 J
Mercury	5.7	2.8	0.0860 J	0.370 J	0.280 J	0.260 J	0.0850 J	2.30 J	0.0470 J	0.0580 J
Nickel	10,000	310	19.9 J	76.8 J	22.6 J	17.7 J	20.2 J	74.4 J	35.6 J	23.6 J
Potassium	- -	- -	1,170	1,220	1,690	1,060	898	1,310	1,170	977
Selenium	6,800	1,500	<0.22 J	<0.27 J	<0.28 J	<0.27 J	<0.27 J	<0.27 J	<0.28 J	<0.28 J
Silver	6,800	1,500	0.200 B	0.210 B	0.310 B	0.170 B	0.150 B	0.930	<0.130	0.160 B
Sodium	- -	- -	<5,000	<5,000	<5,000	<5,000	<5,000	<5,000	<5,000	<5,000
Thallium	- -	- -	0.630 BJ	1.40	1.40	0.940 B	0.890 B	5.10	1.00 B	1.50
Vanadium	- -	- -	15.6	19.8	33.4	18.0	20.5	47.6	22.9	23.2
Zinc	10,000	10,000	305 J	114 J	140 J	112 J	88.6 J	1,530 J	90.0 J	86.3 J

See notes on Page 6.

TABLE 4
SUMMARY OF SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SS-9	SS-10	MW-1	MW-2	MW-7	MW-8	
Sample Depth(Feet):	Industrial	Commercial	0 - 0.5	0.1 - 0.2	36 - 38	4.7 - 5.7	24 - 26	11.3 - 13.1	18 - 20
Date Collected:	(Bold)	(Shaded)	06/25/04	06/30/04	06/15/04	06/18/04	06/14/04	06/23/04	06/22/04
Aluminum	- -	- -	11,100 J	8,780 J	10,800	13,800	10,700	14,200 J	14,800
Antimony	- -	- -	1.00 J	1.60 J	<10.0 J	<10.0 J	<10.0 J	0.970 BJ	<10.0
Arsenic	16	16	6.50 J	4.30 J	5.70	4.40	6.30	5.20 J	5.90 J
Barium	10,000	400	70.0 J	177 J	85.4	91.2	107	93.6 J	83.0 J
Beryllium	2,700	590	0.490 B	0.770	0.560 B	0.750	0.510 B	0.800	0.810 J
Cadmium	60	9.3	0.550	1.40	0.520 B	0.560 B	0.530 B	0.500 B	0.440 BJ
Calcium	- -	- -	4,420 J	47,700 J	31,900	25,000	34,300	27,000 J	1,630
Chromium	- -	- -	15.3	18.8	14.6 J	16.3 J	15.3 J	16.6	19.5 J
Cobalt	- -	- -	10.1 J	7.00 J	9.90	9.80	10.7	10.9 J	10.8 E
Copper	10,000	270	36.4 J	44.0 J	26.9	26.3	29.5	31.6 J	26.3 J
Iron	- -	- -	26,000 J	40,300 J	23,300	23,300	25,200	25,700 J	29,300 E
Lead	3,900	1,000	17.9 J	82.3 J	9.90	59.6	11.6	44.1 J	12.1
Magnesium	- -	- -	5,430 J	6,240 J	11,000	7,400	10,200	7,680 J	5,510
Manganese	10,000	10,000	662 J	1,030 J	532	447	675	466 J	748 E*
Mercury	5.7	2.8	0.0610 J	0.160 J	0.0370 BJ	0.0670 J	0.0310 BJ	0.140 J	0.0220 B
Nickel	10,000	310	22.9 J	20.8 J	21.1 J	20.6 J	22.8 J	23.2 J	24.2 EN
Potassium	- -	- -	993	1,020	1,970	2,550	1,810	2,630	1,630
Selenium	6,800	1,500	<0.27 J	<0.27 J	<0.260 J	<0.260 J	<0.250 J	<0.340 J	R
Silver	6,800	1,500	0.180 B	0.280 B	0.260 B	0.240 B	0.310 B	<0.160	<0.140
Sodium	- -	- -	<5,000	364 B	<5,000	433 B	<5,000	<5,000	131 BJ
Thallium	- -	- -	1.00	3.10	<0.410 J	0.880 BJ	0.630 BJ	1.80	1.50 J
Vanadium	- -	- -	22.3	41.8	19.9	27.3	19.7	27.9	25.2 J
Zinc	10,000	10,000	79.3 J	98.0 J	56.6 J	60.5 J	59.4 J	63.5 J	57.2 EN

See notes on Page 6.

TABLE 4
SUMMARY OF SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-9	MW-10		MW-11	MW-12	MW-13	
Sample Depth(Feet): Date Collected:	Industrial (Bold)	Commercial (Shaded)	10 - 12 05/12/05	10 - 12 05/11/05	12 - 14 05/11/05	14 - 16 05/12/05	5 - 7 05/16/05	8 - 10 09/06/05	14 - 16 09/06/05
Aluminum	- -	- -	17,400	9,020	11,500	13,900	13,700	14,600 J	12,500 J
Antimony	- -	- -	1.00 BJ	0.790 BJ	0.820 BJ	0.940 BJ	0.710 BJ	<0.230 J	<0.170 J
Arsenic	16	16	4.50 J	6.10 J	7.20 J	3.40 J	11.9 J	9.70	2.60
Barium	10,000	400	143 J	107 J	103 J	93.9 J	89.1 J	113	63.3
Beryllium	2,700	590	1.00 J	0.550 J	0.650 J	0.850 J	0.910 J	0.860	0.650
Cadmium	60	9.3	<0.0300	<0.0200	<0.0200	<0.0300	<0.0300	<0.0300 J	<0.0200 J
Calcium	- -	- -	19,400 J	NA	34,000 J	17,000 J	34,100 J	27,800	18,400
Chromium	- -	- -	21.4	15.4	24.4	16.9	16.9	17.5 J	14.3 J
Cobalt	- -	- -	13.2	10.7	12.1	11.0	10.8	10.7 J	9.40 J
Copper	10,000	270	30.4	32.6	36.5	26.2	26.8	27.0	19.9
Iron	- -	- -	33,600 J	NA	28,500 J	27,300 J	32,000 J	33,400 J	22,400 J
Lead	3,900	1,000	13.6 J	NA	14.7 J	9.50 J	8.40 J	7.90 J	6.20 J
Magnesium	- -	- -	10,500	10,900	10,200	7,150	7,600	7,940 J	6,830 J
Manganese	10,000	10,000	488	476	599	399	488	416 J	350 J
Mercury	5.7	2.8	<0.0490	<0.0470	<0.0790	<0.0640	<0.0540	0.0250 B	0.0320 B
Nickel	10,000	310	31.8	24.0	27.8	24.5	21.8	21.4 J	17.8 J
Potassium	- -	- -	3,080	1,560	2,160	2,540	2,570	3,060	2,690
Selenium	6,800	1,500	R	R	R	R	R	0.790 J	0.580 J
Silver	6,800	1,500	<0.0800	<0.0800	<0.0800	<0.0800	<0.0800	<0.0900	<0.0700
Sodium	- -	- -	169 BJ	149 BJ	167 BJ	205 BJ	405 BJ	<672	<501
Thallium	- -	- -	<0.360 J	<0.630 J	<0.350 J	<0.360 J	<0.370 J	<0.380 J	<0.280 J
Vanadium	- -	- -	26.7	22.7	22.8	27.0	29.3	31.0 J	23.5 J
Zinc	10,000	10,000	80.2 J	NA	83.1 J	64.2 J	68.4 J	63.3 J	50.8 J

See notes on Page 6.

TABLE 4
SUMMARY OF SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		MW-14		SB-1	SB-3	SB-4	SB-6	SB-9	SB-10
Sample Depth(Feet):	Industrial	Commercial	14 - 16	20 - 22	14.5 - 15.4	10 - 12	14 - 16	20 - 21	10.8 - 13.1	28 - 32
Date Collected:	(Bold)	(Shaded)	09/09/05	09/09/05	06/11/04	06/17/04	06/08/04	06/16/04	06/10/04	06/24/04
Aluminum	- -	- -	14,500 J [12,600 J]	12,600 J	11,900	19,400	15,800	14,700 [10,400]	8,620	9,240 E
Antimony	- -	- -	<0.210 J [<0.220 J]	<0.220 J	<10.0 J	<10.0 J	<10.0 J	<10.0 J [<10.0 J]	<10.0 J	0.820 BJ
Arsenic	16	16	3.70 [6.60]	4.30	7.00	5.40	5.80	5.90 [5.40]	5.20	6.00 J
Barium	10,000	400	105 [98.1]	87.7	90.2	164	135	143 [87.8]	71.2	72.7 E
Beryllium	2,700	590	0.750 [0.650]	0.580 B	0.700	0.980	0.830	0.780 [0.520 B]	0.480 B	0.400 B
Cadmium	60	9.3	0.0200 J [<0.0300 J	<0.0300 J	0.670	0.780	0.580 B	0.630 B [0.490 B]	0.390 B	0.430 B
Calcium	- -	- -	23,300 [31,000]	55,400	30,000	35,100	24,300	29,400 [36,800]	34,000	28,500 E
Chromium	- -	- -	17.4 J [16.6 J]	16.4 J	16.5 J	23.9 J	20.6 E	18.0 J [13.4 J]	10.9 J	13.5
Cobalt	- -	- -	10.5 J [9.20 J]	11.5 J	12.1	13.7	12.1	11.1 [9.10]	6.30	9.50 E
Copper	10,000	270	24.4 [24.3]	25.0	71.7	34.2	30.5	30.5 [25.6]	145	29.4 E
Iron	- -	- -	27,300 J [26,800 J]	26,500 J	27,600	34,000	30,400	27,300 [21,800]	16,500	23,100 E
Lead	3,900	1,000	7.10 J [6.90 J]	10.4 J	94.5	13.7	11.6	22.5 [11.7]	66.5	10.4 E
Magnesium	- -	- -	8,380 J [8,190 J]	11,500 J	7,040	12,400	9,800	10,800 [10,300]	6,650	9,490 E
Manganese	10,000	10,000	467 J [433 J]	741 J	424	705	546	525 [509]	303	572 E
Mercury	5.7	2.8	0.0400 [0.0480]	0.0400 B	0.100 J	0.0410 BJ	0.0360 BJ	.0380 BJ [0.0300 B	0.120 J	0.140 J
Nickel	10,000	310	21.3 J [18.6 J]	22.0 J	24.5 J	31.4 J	28.4 E	24.9 J [19.5 J]	15.7 J	20.7 E
Potassium	- -	- -	3,100 [2,660]	2,550	2,140	3,460	2,790	3,500 [2,180]	1,530	1,430
Selenium	6,800	1,500	0.590 BJ [0.650 J]	0.690 J	<0.250 J	<0.290 J	<0.290 J	<0.280 J [<0.260 J]	<0.230 J	<0.310 J
Silver	6,800	1,500	<0.0900 [<0.0900]	<0.0900	0.250 B	0.280 B	0.260 B	0.280 B [0.190 B]	0.240 B	<0.140
Sodium	- -	- -	<616 [<642]	586 B	268 B	276 B	269 B	284 B [250 B]	<5,000	<5,000
Thallium	- -	- -	<0.340 J [<0.360 J]	<0.370 J	0.830 BJ	1.20 BJ	1.30 BJ	0.660 BJ [0.570 BJ]	0.500 BJ	1.60
Vanadium	- -	- -	29.1 J [28.4 J]	23.2 J	26.8	31.3	26.4	24.7 [19.3]	25.1	16.9
Zinc	10,000	10,000	61.1 J [54.5 J]	59.1 J	94.7 J	72.0 J	74.5 E	72.3 J [53.4 J]	50.1 J	57.2 NE

See notes on Page 6.

TABLE 4
SUMMARY OF SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	6 NYCRR PART 375 SCOs		SB-11		SB-12		SB-13		TP-2
Sample Depth(Feet): Date Collected:	Industrial (Bold)	Commercial (Shaded)	6 - 10 05/11/05	16 - 20 05/11/05	2 - 4 05/17/05	12 - 14 05/17/05	2 - 4 05/17/05	16 - 18 05/17/05	2 - 2.5 06/24/04
Aluminum	- -	- -	9,480	7,500 [8,610]	7,990	8,860	10,400	10,700	7,870 J
Antimony	- -	- -	0.620 BJ	0.730 BJ [0.780 BJ]	0.460 BJ	1.10 BJ	0.600 BJ	0.660 BJ	2.60 J
Arsenic	16	16	7.80 J	5.10 J [5.20 J]	3.80 J	5.30 J	4.50 J	5.80 J	8.60 J
Barium	10,000	400	74.8 J	59.2 J [68.0 J]	44.1 J	52.9 J	67.0 J	71.7 J	63.2 J
Beryllium	2,700	590	0.510 J	0.460 J [0.510 J]	0.480 BJ	0.530 BJ	0.620 J	0.630 J	0.430 B
Cadmium	60	9.3	0.260 B	<0.0200 [<0.0200]	<0.0200	<0.0300	<0.0200	<0.0300	1.40
Calcium	- -	- -	23,600 J	44,800 J [77,900 J]	15,900 J	20,800 J	16,200 J	18,200 J	9,750 J
Chromium	- -	- -	13.9	12.5 [13.5]	11.9	12.8	13.0	14.0	16.3
Cobalt	- -	- -	11.1	8.40 [8.80]	8.30	8.10	8.50	8.70	27.5 J
Copper	10,000	270	24.5	39.9 [34.9]	23.8	29.2	22.4	25.6	58.1 J
Iron	- -	- -	23,500 J	22,000 J [22,000 J]	17,400 J	20,400 J	21,500 J	23,600 J	89,500 J
Lead	3,900	1,000	21.2 J	34.0 J [65.3 J]	36.8 J	46.8 J	27.3 J	36.8 J	91.1 J
Magnesium	- -	- -	6,510	15,400 [34,500]	5,440	6,420	5,100	6,260	2,820 J
Manganese	10,000	10,000	1,240	426 [424]	297	550	455	451	1,760 J
Mercury	5.7	2.8	<0.0570	<0.0850 [<0.0670]	0.530	0.230	0.120	0.150	0.370 J
Nickel	10,000	310	20.1	18.4 [19.4]	16.7	18.2	18.8	20.0	30.3 J
Potassium	- -	- -	1,070	1,450 [1,770]	1,500	1,740	1,890	2,030	1,170
Selenium	6,800	1,500	R	R [R]	R	R	R	R	<0.280 J
Silver	6,800	1,500	<0.0700	<0.0700 [<0.0700]	<0.0700	<0.0800	<0.0700	<0.0800	0.390 B
Sodium	- -	- -	162 BJ	216 BJ [221 BJ]	185 BJ	189 BJ	199 BJ	173 BJ	<5,000
Thallium	- -	- -	<0.380 J	<0.330 J [<0.340 J]	<0.330 J	<0.350 J	<0.350 J	<0.350 J	4.70
Vanadium	- -	- -	14.0	17.9 [19.5]	17.0	18.3	20.0	20.2	32.8
Zinc	10,000	10,000	640 J	53.6 J [51.6 J]	55.1 J	56.6 J	54.7 J	59.3 J	84.5 J

See notes on Page 6.

TABLE 4
SUMMARY OF SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by ARCADIS of New York, Inc. on the dates indicated.
2. Samples were analyzed by CompuChem located in Cary, North Carolina for Inorganics using United States Environmental Protection Agency (USEPA) SW-846 Methods 6010, 7470/7471, and 9010.
3. Only those constituents detected in one or more samples are summarized.
4. Concentrations reported in dry weight parts per million (ppm), which is equivalent to milligrams per kilogram (mg/kg).
5. Field duplicate sample results are presented in brackets.
6. Data qualifiers are defined as follows:
   - < = Constituent not detected at a concentration above the reported detection limit.
   - B = The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
   - J = The compound was positively identified; however the associated numerical value is an estimated concentration only.
   - R = The sample results are rejected.
7. 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) are from the Draft and Proposed New Superfund/Brownfield Regulations released for public comment on July 5, 2006.
8. Bold font indicates that the result exceeds the 6 NYCRR Part 375 Industrial Use SCO.
9. Shading indicates that the result exceeds the 6 NYCRR Part 375 Commercial Use SCO.
10. - - = No 6 NYCRR Part 375 SCO listed.
11. NA = Not Analyzed.

TABLE 5
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGMENT PLAN

Location ID: / Date Collected:	NYSDEC TOGS 1.1.1 Water Guidance Values	Units	MW-1 07/20/04	MW-1 10/27/05	MW-2 07/22/04	MW-2 10/27/05	MW-3 07/20/04	MW-3 10/25/05	MW-3 06/26/09	MW-4 07/20/04
Detected VOCs										
1,1,1-Trichloroethane	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	5	ug/L	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
2-Butanone	50	ug/L	R	2.5 U	2.4 J	2.5 U	R	2.5 U	2.0 U	R
4-Methyl-2-pentanone	- -	ug/L	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.0 U	2.5 U
Acetone	50	ug/L	R	2.5 UJ	R	2.5 UJ	R	2.5 UJ	2.0 UBJ	R
Benzene	1	ug/L	0.50 U	0.15 J	3.5 U	0.23 J	0.89	0.14 J	16	0.50 U
Carbon Disulfide	60	ug/L	0.11 J	0.50 U	0.12 J	0.50 U	0.50 U	0.50 U	0.50 U	0.45 J
Chloroethane	5	ug/L	0.50 UJ	0.50 U	0.50 U	0.50 U	0.50 UJ	0.50 U	1.0 U	0.50 UJ
Chloroform	7	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloromethane	5	ug/L	1.1 UJ	0.50 UJ	0.50 U	0.50 UJ	1.1 UJ	0.50 UJ	0.50 U	1.2 UJ
Cyclohexane	- -	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ	0.50 U
Ethylbenzene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Isopropylbenzene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
m,p-Xylene	- -	ug/L	1.0 U	1.0 U	0.20 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylcyclohexane	- -	ug/L	0.50 U	0.50 UJ	0.50 U	0.50 UJ	0.50 U	0.50 UJ	0.50 UJ	0.50 U
Methyl-tert-butyl ether	10	ug/L	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
o-Xylene	- -	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Styrene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	5	ug/L	0.50 U	0.50 UJ	0.50 U	0.50 UJ	0.50 U	0.50 UJ	0.50 U	0.50 U
Toluene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.20 J	0.50 U
Trichloroethene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Xylene (total)	5	ug/L	0.50 U	0.50 U	0.22 J	0.50 U	0.50 U	0.50 U	1.0 U	0.50 U
Detected VOC TICs										
1-Propynylbenzene	- -	ug/L	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	10	ug/L	NA	NA	NA	NA	NA	NA	NA	NA
Thiophene	- -	ug/L	NA	NA	NA	NA	NA	NA	NA	NA

See notes on Page 5

TABLE 5
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGMENT PLAN

Location ID: / Date Collected:	NYSDEC TOGS 1.1.1 Water Guidance Values	Units	MW-4 10/25/05	MW-4 06/26/09	MW-5 07/22/04	MW-5 10/26/05	MW-5 06/26/09	MW-6 07/21/04	MW-6 10/26/05
Detected VOCs									
1,1,1-Trichloroethane	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U [0.50 U]
1,1-Dichloroethane	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.30 J	0.50 U [0.50 U]
1,1-Dichloroethene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U [0.50 U]
2-Butanone	50	ug/L	2.5 U	2.0 U	R	2.5 U	2.0 U	R	2.5 U [2.5 U]
4-Methyl-2-pentanone	- -	ug/L	2.5 U	2.0 U	2.5 U	2.5 U	2.0 U	2.5 U	2.5 U [2.5 U]
Acetone	50	ug/L	2.5 UJ	2.0 UBJ	3.0 J	2.5 UJ	2.0 UBJ	R	2.5 UJ [2.5 UJ]
Benzene	1	ug/L	0.50 U	0.50 U	2,400 D	1,200 D	2,300 D	310 D	0.92 [0.93]
Carbon Disulfide	60	ug/L	0.50 U	0.50 U	0.13 J	0.50 U	0.50 U	0.50 U	0.50 U [0.50 U]
Chloroethane	5	ug/L	0.50 U	1.0 U	0.50 UJ	0.50 U	1.0 U	0.50 UJ	0.50 U [0.50 U]
Chloroform	7	ug/L	0.50 U	0.50 U	0.17 J	0.50 U	0.50 U	0.50 U	0.50 U [0.50 U]
Chloromethane	5	ug/L	0.50 UJ	0.50 U	2.5 UJ	0.50 UJ	0.50 U	0.62 J	0.50 UJ [0.50 UJ]
Cyclohexane	- -	ug/L	0.50 U	0.50 UJ	0.38 J	0.47 J	0.34 J	0.50 U	0.50 U [0.50 U]
Ethylbenzene	5	ug/L	0.50 U	0.50 U	17	25	16	0.50 U	0.50 U [0.50 U]
Isopropylbenzene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U [0.50 U]
m,p-Xylene	- -	ug/L	1.0 U	1.0 U	17	29	5.2	1.0 U	1.0 U [1.0 U]
Methylcyclohexane	- -	ug/L	0.50 UJ	0.50 UJ	0.24 J	0.22 J	0.12 J	0.50 U	0.50 U [0.50 U]
Methyl-tert-butyl ether	10	ug/L	0.16 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U [0.50 U]
o-Xylene	- -	ug/L	0.50 U	0.50 U	11	17	8.8	0.50 U	0.50 U [0.50 U]
Styrene	5	ug/L	0.50 U	0.50 U	37 JD	20	5.4	0.50 U	0.50 U [0.50 U]
Tetrachloroethene	5	ug/L	0.50 UJ	0.50 U	0.50 U	0.50 U	0.50 U	0.31 J	0.90 [0.83]
Toluene	5	ug/L	0.50 U	0.20 J	140 D	46 EJ	8.2	0.73 U	0.50 U [0.50 U]
Trichloroethene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.18 J	0.50 U [0.50 U]
Xylene (total)	5	ug/L	0.50 U	1.0 U	31	48	14	0.50 U	0.50 U [0.50 U]
Detected VOC TICs									
1-Propynylbenzene	- -	ug/L	NA	NA	NA	NA	17 JN	NA	NA
Naphthalene	10	ug/L	NA	NA	NA	NA	3.5 JN	NA	NA
Thiophene	- -	ug/L	NA	NA	NA	NA	31 JN	NA	NA

See notes on Page 5

TABLE 5
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGMENT PLAN

Location ID: / Date Collected:	NYSDEC TOGS 1.1.1 Water Guidance Values	Units	MW-6 06/25/09	MW-7 07/22/04	MW-7 10/27/05	MW-7 06/25/09	MW-8 07/21/04	MW-8A 06/26/09	MW-9 10/26/05
Detected VOCs									
1,1,1-Trichloroethane	5	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	.50 U [0.21 J	0.50 U	0.50 U
1,1-Dichloroethane	5	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	6.8 [8.0]	5.9	0.50 U
1,1-Dichloroethene	5	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	1.2 [1.2]	2.0 J	0.50 U
2-Butanone	50	ug/L	2.0 U [2.0 U]	R	2.5 U	2.0 U	R [R]	2.0 U	2.5 U
4-Methyl-2-pentanone	- -	ug/L	2.0 U [2.0 U]	2.5 U	2.5 U	2.0 U	3.4 [3.2]	2.0 U	2.5 U
Acetone	50	ug/L	2.0 UBJ [2.0 UBJ]	2.1 J	2.5 UJ	2.0 UBJ	38 J [39 J]	2.0 UBJ	2.5 UJ
Benzene	1	ug/L	0.19 J [0.21 J]	0.50 U	0.21 J	0.50 U	47 D [76 D]	0.50 U	0.50 U
Carbon Disulfide	60	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	.50 U [0.50 U	0.50 U	0.50 U
Chloroethane	5	ug/L	1.0 U [1.0 U]	0.50 UJ	0.50 U	1.0 U	2.0 J [2.0 J]	1.0 U	0.50 U
Chloroform	7	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	0.87 [0.50 U]	0.50 U	0.29 J
Chloromethane	5	ug/L	0.50 U [0.50 U]	1.0 U	0.50 UJ	0.50 U	.50 UJ [1.2 J	0.50 UJ	0.50 UJ
Cyclohexane	- -	ug/L	0.50 UJ [0.50 UJ]	0.50 U	0.50 U	0.50 UJ	28 D [42 D]	0.50 U	0.50 U
Ethylbenzene	5	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	9.8 [8.9]	0.50 U	0.50 U
Isopropylbenzene	5	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	1.9 [1.8]	0.50 U	0.50 U
m,p-Xylene	- -	ug/L	1.0 U [1.0 U]	1.0 U	1.0 U	1.0 U	35 [32]	1.0 U	1.0 U
Methylcyclohexane	- -	ug/L	0.50 UJ [0.50 UJ]	0.18 J	0.50 UJ	0.50 UJ	22 D [33 D]	0.50 U	0.50 U
Methyl-tert-butyl ether	10	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	.50 U [0.50 U	0.50 U	0.50 U
o-Xylene	- -	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	11 [10]	0.50 U	0.50 U
Styrene	5	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	.50 U [0.50 U	0.50 U	0.50 U
Tetrachloroethene	5	ug/L	0.74 [0.71]	0.50 U	0.50 UJ	0.50 U	.50 U [0.50 U	0.50 U	0.50 U
Toluene	5	ug/L	0.50 U [0.50 U]	0.50 U	0.50 U	0.50 U	6.3 [5.9]	0.50 U	0.50 U
Trichloroethene	5	ug/L	0.25 J [0.21 J]	0.50 U	0.50 U	0.50 U	.50 U [0.50 U	0.50 U	0.50 U
Xylene (total)	5	ug/L	1.0 U [1.0 U]	0.50 U	0.50 U	1.0 U	51 [47]	1.0 U	0.50 U
Detected VOC TICs									
1-Propynylbenzene	- -	ug/L	NA	NA	NA	NA	NA	NA	NA
Naphthalene	10	ug/L	NA	NA	NA	NA	NA	NA	NA
Thiophene	- -	ug/L	NA	NA	NA	NA	NA	NA	NA

See notes on Page 5

TABLE 5
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGMENT PLAN

Location ID: Date Collected:	NYSDEC TOGS 1.1.1 Water Guidance Values	Units	MW-9 06/25/09	MW-10 10/26/05	MW-10 06/25/09	MW-11 10/25/05	MW-12 10/25/05	MW-13 10/27/05	MW-14 10/27/05	MW-14 06/26/09
Detected VOCs										
1,1,1-Trichloroethane	5	ug/L	0.50 U	14	6.2	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	5	ug/L	0.50 U	0.53	0.57	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	5	ug/L	0.50 U	4.6	3.7 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
2-Butanone	50	ug/L	2.0 U	2.5 U	2.0 U	2.5 U	2.5 U	2.5 U	2.5 U	2.0 U
4-Methyl-2-pentanone	- -	ug/L	2.0 U	2.5 U	2.0 U	2.5 U	2.5 U	2.5 U	2.5 U	2.0 U
Acetone	50	ug/L	2.0 UJ	2.5 UJ	2.0 UBJ	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.0 UBJ
Benzene	1	ug/L	0.50 U	1.2	0.50 U	17	0.50 U	0.50 U	0.50 U	0.50 U
Carbon Disulfide	60	ug/L	0.50 U	0.50 U	0.50 U	0.29 J	0.50 U	0.13 J	0.50 U	0.50 U
Chloroethane	5	ug/L	1.0 U	0.50 U	1.0 U	0.50 U	0.50 U	0.50 U	0.50 U	1.0 U
Chloroform	7	ug/L	0.50 U	0.29 J	0.19 J	0.13 J	0.50 U	0.50 U	0.50 U	0.50 U
Chloromethane	5	ug/L	0.50 U	0.50 UJ	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ
Cyclohexane	- -	ug/L	0.50 UJ	0.50 U	0.50 UJ	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Isopropylbenzene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
m,p-Xylene	- -	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylcyclohexane	- -	ug/L	0.50 UJ	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 U
Methyl-tert-butyl ether	10	ug/L	0.50 U	0.50 U	0.50 U	0.15 J	0.50 U	0.89	0.16 J	0.50 U
o-Xylene	- -	ug/L	0.50 U	0.27 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Styrene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	5	ug/L	0.50 U	1.2	0.43 J	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 U
Toluene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	5	ug/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Xylene (total)	5	ug/L	1.0 U	0.27 J	1.0 U	0.50 U	0.50 U	0.50 U	0.50 U	1.0 U
Detected VOC TICs										
1-Propynylbenzene	- -	ug/L	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	10	ug/L	NA	NA	NA	NA	NA	NA	NA	NA
Thiophene	- -	ug/L	NA	NA	NA	NA	NA	NA	NA	NA

See notes on Page 5

TABLE 5
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by ARCADIS of New York, Inc. on the dates indicated.
2. VOCs = Volatile Organic Compounds.
3. Samples collected prior to 2009 were analyzed by CompuChem located in Cary, North Carolina for VOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8260.
4. Samples collected in 2009 were analyzed by TestAmerica in Shelton, CT for VOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8260.
5. Only those constituents detected in one or more samples are summarized.
6. Concentrations reported in parts per billion (ppb), which is equivalent to micrograms per liter (ug/L).
7. Field duplicate sample results are presented in brackets.
8. Data qualifiers are defined as follows:
   - U = Constituent not detected at a concentration above the reported detection limit.
   - UJ = The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.
   - D = Concentration is based on a diluted sample analysis.
   - E = The compound was quantitated above the quantitation range.
   - B = The compound was found in the sample as well as its associated blank, its presence in the sample may be suspect
   - J = The compound was positively identified; however the associated numerical value is an estimated concentration only.
   - R = The sample results are rejected.
9. NYSDEC Groundwater Standards/Guidance Values are from the New York State Department Environmental Conservation (NYSDEC) Division of Water, Technical and Operational Guidance Series (TOGS) document titled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (TOGS 1.1.1) dated June 1998, revised April 2000 and June 2004.
10. Shading indicates that the result exceeds the TOGS 1.1.1 Water Quality Standard/Guidance Value.
11. - - = No TOGS 1.1.1 Water Quality Standard/Guidance Value listed.

TABLE 6
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED SVOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	NYSDEC Groundwater	MW-1		MW-2		MW-3	
Date Collected:	Standards/Guidance Values	07/20/04	10/27/05	07/22/04	10/27/05	07/20/04	10/25/05
Anthracene	50	<10	<10	<10	<10	<10	<10
Carbazole	- -	<10 J	<10	<10 J	<10	<10 J	<10
Diethylphthalate	50	<10	<10	<10	<10	<10	<10
Naphthalene	10	<10	<10	<10	<10	<10	<10
Phenol	1	<10	<10	<10	<10	<10	<10

See notes on Page 4.

TABLE 6
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED SVOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	NYSDEC Groundwater	MW-4		MW-5		MW-6		MW-7	
Date Collected:	Standards/Guidance Values	07/20/04	10/25/05	07/22/04	10/26/05	07/21/04	10/26/05	07/22/04	10/27/05
Anthracene	50	<10	<10	<10	<10	4.0 J	<10 [<10]	<10	<10
Carbazole	- -	<10 J	<10	<10 J	<10	3.0 J	<10 [<10]	<10 J	<10
Diethylphthalate	50	<10	<10	<10	1.7 J	<10	<10 [<10]	<10	<10
Naphthalene	10	<10	<10	2.0 J	2.0 J	<10	<10 [<10]	<10	<10
Phenol	1	<10	<10	<10	3.0 J	4.0 J	<10 [<10]	<10	<10

See notes on Page 4.

TABLE 6
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR DETECTED SVOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID: Date Collected:	NYSDEC Groundwater Standards/Guidance Values	MW-8 07/21/04	MW-9 10/26/05	MW-10 10/26/05	MW-11 10/25/05	MW-12 10/25/05	MW-13 10/27/05	MW-14 10/27/05
Anthracene	50	<10 [<10]	<10	<10	<10	<10	<10	<10
Carbazole	- -	<10 J [<10 J]	<10	<10	<10	<10	<10	<10
Diethylphthalate	50	<10 [<10]	<10	<10	<10	<10	<10	<10
Naphthalene	10	<10 [<10]	<10	<10	<10	<10	<10	<10
Phenol	1	<10 [<10]	<10	<10	<10	<10	<10	<10

See notes on Page 4.

TABLE 6
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR SVOCs (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by ARCADIS of New York, Inc. on the dates indicated.
2. SVOCs = Semi Volatile Organic Compounds.
3. Samples were analyzed by CompuChem located in Cary, North Carolina for SVOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8270.
4. Only those constituents detected in one or more samples are summarized
   Concentrations reported in parts per billion (ppb), which is equivalent to micrograms per liter (ug/L).
5. Field duplicate sample results are presented in brackets.
6. Data qualifiers are defined as follows:
   - < = Constituent not detected at a concentration above the reported detection limit
   - J = The compound was positively identified; however the associated numerical value is an estimated concentration only
7. NYSDEC Groundwater Standards/Guidance Values are from the New York State Department Environmental Conservation (NYSDEC) Division of Water, Technical and Operational Guidance Series (TOGS) document titled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (TOGS 1.1.1) dated June 1998, revised April 2000 and June 2004
8. Shading indicates that the result exceeds the TOGS 1.1.1 Water Quality Standard/Guidance Value
9. - - = No TOGS 1.1.1 Water Quality Standard/Guidance Value listed.

TABLE 7
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppb)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	NYSDEC Groundwater Standards/Guidance Values	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
Date Collected:		07/20/04	07/22/04	07/20/04	07/20/04	07/22/04	07/21/04	07/22/04	07/21/04
Aluminum	- -	163 B	327	568	<96.9	<96.9	<96.9	1,150	544 [527]
Antimony	3	2.30 B	2.50 B	<2.20	3.40 B	<2.20	5.40 B	<2.20	<2.20 [<2.20]
Arsenic	25	9.00 B	13.4	4.80 B	<1.90	7.80 B	114	<1.90	<1.90 [<1.90]
Barium	1,000	62.2 B	704	79.1 B	80.3 B	95.8 B	77.2 B	301	137 B [126 B]
Calcium	- -	39,200	137,000	105,000	70,100	68,300	80,100	12,000	103,000 [98,900]
Cobalt	- -	<0.600	<0.600	0.670 B	<0.600	<0.600	<0.600	<0.600	1.50 B [1.40 B]
Copper	200	<5.00	<5.00	<5.00	<5.00	<5.00	2.40 B	<5.00	<5.00 [<5.00]
Cyanide	200	<3.90 J	11.9 J	<3.90 J	<3.90 J	<3.90 J	17.9 J	<3.90 J	12.8 J [56.7 J]
Iron	300	<56.6	11,400	662	<56.6	510	<56.6	1,430	1,420 [1,430]
Magnesium	35,000	53,200	45,000	99,800	45,900	46,400	21,600	10,000	80,100 [79,000]
Manganese	300	23.2	2,700	223	153	40.2	57.5	42.1	4,750 [4,500]
Nickel	100	<0.700	<0.700	1.60 B	1.50 B	0.710 B	4.20 B	1.40 B	1.40 B [1.60 B]
Potassium	- -	1,200 B	3,620 B	2,470 B	35,200	3,320 B	11,100	1,530 B	2,390 B [2,090 B]
Sodium	20,000	37,100	63,300	134,000	81,300	35,900	25,900	75,900	61,200 [56,500]
Vanadium	- -	<0.800	<0.800	1.30 B	<0.800	<0.800	2.00 B	2.00 B	<0.800 [<0.800]

Notes:

1. Samples were collected by ARCADIS of New York, Inc. (ARCADIS BBL) on the dates indicated.
2. Samples were analyzed by CompuChem located in Cary, North Carolina for VOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8260.
3. Only those constituents detected in one or more samples are summarized.
4. Concentrations reported in parts per billion (ppb), which is equivalent to micrograms per liter (ug/L).
5. Field duplicate sample results are presented in brackets.
6. Data qualifiers are defined as follows:
   < = Constituent not detected at a concentration above the reported detection limit.
   B = The compound has been found in the sample as well as the associated blank, its presence in the sample may be suspect.
   J = The compound was positively identified; however the associated numerical value is an estimated concentration only.
7. NYSDEC Groundwater Standards/Guidance Values are from the New York State Department Environmental Conservation (NYSDEC) Division of Water, Technical and Operational Guidance Series (TOGS) document titled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (TOGS 1.1.1) dated June 1998, revised April 2000 and June 2004.
8. Shading indicates that the result exceeds the TOGS 1.1.1 Water Quality Standard/Guidance Value.
9. - - = No TOGS 1.1.1 Water Quality Standard/Guidance Value listed.

TABLE 8
SUMMARY OF AMBIENT AIR AND SOIL-GAS ANALYTICAL RESULTS FOR DETECTED VOCs (ug/m^3) - 2007

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	AA-1	AA-2	SG-1	SG-2	SG-3	SG-5	SG-6
Date Collected:	04/19/07	04/19/07	04/19/07	04/19/07	04/19/07	04/19/07	04/19/07
1,1,1-Trichloroethane	<1.1 J	<1.1 J	<22 J	550 J	320 J	<39 J	<53 J
2,2,4-Trimethylpentane	<0.93 J	<0.93 J	2,100 J	4,700 J	2,800 J	3,000 J	5,100 J
2-Butanone	<1.5 J	<1.5 J	53 J	97 J	<53 J	<53 J	120 J
Acetone	<12 J	<12 J	1,400 J	5,500 J	2,400 J	2,000 J	3,300 J
Chloromethane	<1.0 J	1.1 J	<21 J	<62 J	<37 J	<37 J	<52 J
Toluene	1.3 J	1.4 J	17 J	68 J	41 J	<27 J	57 J

Notes:

1. Samples were collected by ARCADIS of New York, Inc. (ARCADIS BBL) on the dates indicated.
2. VOCs = Volatile Organic Compounds.
3. Samples were analyzed by Severn Trent Laboratories, Inc. located in Burlington, Vermont for total VOCs in soil vapor following United States Environmental Protection Agency (USEPA) Method TO-15.
4. Only those constituents detected in one or more samples are summarized.
5. Concentrations reported in micrograms per cubic meter (ug/m^3).
6. Data qualifiers are defined as follows:

   < = Constituent not detected at a concentration above the reported detection limit.

   J = The compound was positively identified; however the associated numerical value is an estimated concentration on

TABLE 9
SUMMARY OF AMBIENT AIR AND SOIL-GAS ANALYTICAL RESULTS FOR DETECTED VOCs (ug/m3) - 2009

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:		AA-3	AA-4	SG-101	SG-102	SG-103	SG-104	SG-106	SG-107	SG-108-Temp
Date Collected:	Units	10/29/09	10/30/09	10/29/09	10/30/09	10/30/09	10/30/09	10/29/09	10/29/09	10/29/09
Detected VOCs										
1,1,1-Trichloroethane	ug/m3	1.1 U	1.1 U	5.5	3,000 D	440 D [450 D]	93	6.9	17	2.3
1,1,2,2-Tetrachloroethane	ug/m3	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U [1.4 U]	3.4 U	2.6	1.4 U	30
1,1,2-Trichloro-1,2,2-trifluoroethan	ug/m3	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U [1.5 U]	3.8 U	1.5 U	1.5 U	1.6
1,1,2-Trichloroethane	ug/m3	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U [1.1 U]	2.7 U	1.8	1.1 U	15
1,1-Dichloroethane	ug/m3	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U [0.81 U]	2.0 U	0.81 U	2.3	0.81 U
1,2,3,5-Tetramethylbenzene	ug/m3	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U [1.1 U]	2.7 U	1.1 U	1.1 U	1.1 J
1,2,3-Trimethylbenzene	ug/m3	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U [0.98 U]	2.5 U	0.98 U	0.98 U	1.3 J
1,2,4-Trimethylbenzene	ug/m3	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U [0.98 U]	2.5 U	1.1	0.98 U	4.0
1,2-Dichloroethane	ug/m3	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U [0.81 U]	2.0 U	1.7	0.81 U	2.2
1,2-Dichloropropane	ug/m3	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U [0.92 U]	2.3 U	12	0.92 U	63
1,2-Dichlorotetrafluoroethane	ug/m3	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U [1.4 U]	3.5 U	1.4 U	3.7 J	1.4 U
1,3,5-Trimethylbenzene	ug/m3	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U [0.98 U]	2.5 U	0.98 U	0.98 U	1.2
2-Butanone	ug/m3	2.9 U	2.9 U	1.3 J	2.9 U	2.9 U [2.9 U]	7.4 U	3.8	1.4 J	3.5
2-Hexanone	ug/m3	2.0 UJ	2.0 UJ	2.0 U	2.0 UJ	0.26 J [2.0 UJ]	5.1 UJ	0.63 J	2.0 UJ	1.1 J
3-Chloropropene	ug/m3	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U [0.63 U]	1.6 U	0.61 J	0.63 U	0.41 J
4-Ethyltoluene	ug/m3	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U [2.0 U]	4.9 U	2.0 U	2.0 U	1.3 J
4-Methyl-2-pentanone	ug/m3	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U [2.0 U]	5.1 U	2.0 U	2.0 U	11
Acetone	ug/m3	17 J	11 J	12	4.1 J	6.6 J [7.4 J]	10 J	92 J	20 J	120
Benzene	ug/m3	1.4	2.8	0.64 U	0.85	1.0 [1.8]	1.6 U	1.3	0.81	2.9
Bromodichloromethane	ug/m3	1.3 U	1.3 U	4.9	1.3 U	1.3 U [1.3 U]	3.4 U	1.3 U	1.3 U	1.3 U
Carbon Disulfide	ug/m3	1.6 U	1.6 U	0.40 J	0.12 J	0.25 J [0.41 J]	2.3 J	5.8	0.66 J	7.4
Carbon Tetrachloride	ug/m3	0.63 J	0.69 J	0.68 J	1.1 J	1.3 U [1.3 U]	2.7 J	12	12	130
Chloroethane	ug/m3	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U [0.53 U]	1.3 U	2.2	0.53 U	2.5
Chloroform	ug/m3	0.98 U	0.98 U	65	1.4	0.98 U [0.98 U]	4.0	10	41	5.5
Chloromethane	ug/m3	1.4	1.8	1.0 U	1.0 U	1.0 U [1.0 U]	2.6 U	10	1.0 U	16
Dichlorodifluoromethane	ug/m3	3.3	3.4	3.2	5.1	4.1 [4.4]	7.8	3.2	4.2	3.2
Ethanol	ug/m3	17 J	130 J	3.8 U	4.0 J	8.4 J [14 J]	9.4 U	35 J	54 J	23 J
Ethylbenzene	ug/m3	0.87 U	1.1	0.87 U	0.87 U	0.87 U [0.94]	2.2 U	1.1	4.7	1.7
Isopropyl Alcohol	ug/m3	5.1	23	2.6 J	1.9 J	3.1 J [3.8 J]	2.5 J	47	28	160
m,p-Xylene	ug/m3	1.1	3.6	0.96	1.6	1.3 [2.8]	2.2 U	3.4	17	6.2
Methylene Chloride	ug/m3	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U [1.7 U]	4.3 U	7.3	1.7 U	1.7 U
Naphthalene	ug/m3	2.6 UJ	2.6 UJ	2.6 UJ	7.4 J	0.69 J [2.6 UJ]	6.6 UJ	9.8 J	3.5 J	8.0 J
n-Butane	ug/m3	5.2	25	2.2	5.5	5.4 [6.0]	3.9	29	2.4	2.8
n-Decane	ug/m3	5.8 U	0.62 J	1.7 J	0.63 J	0.88 J [0.67 J]	1.3 J	0.72 J	1.8 J	2.6 J
n-Dodecane	ug/m3	7.0 U	7.0 U	1.1 J	0.61 J	7.0 U [7.0 U]	17 U	7.0 U	2.0 J	13
n-Heptane	ug/m3	0.87 J	2.0 J	1.2 J	0.66 J	0.67 J [1.2 J]	1.3 J	1.2 J	0.80 J	3.9
n-Hexane	ug/m3	2.1	5.2	1.8 U	1.9	2.2 [3.0]	4.4 U	6.9	1.8 U	5.2
n-Octane	ug/m3	0.22 J	0.51 J	1.1 J	0.30 J	0.21 J [0.37 J]	0.84 J	0.45 J	0.48 J	2.8

See notes on Page 3.

TABLE 9
SUMMARY OF AMBIENT AIR AND SOIL-GAS ANALYTICAL RESULTS FOR DETECTED VOCs (ug/m3) - 2009

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:		AA-3	AA-4	SG-101	SG-102	SG-103	SG-104	SG-106	SG-107	SG-108-Temp
Date Collected:	Units	10/29/09	10/30/09	10/29/09	10/30/09	10/30/09	10/30/09	10/29/09	10/29/09	10/29/09
Nonane	ug/m3	2.6 U	0.45 J	1.3 J	2.6 U	2.6 U [2.6 U]	0.76 J	2.6 U	0.61 J	1.2 J
n-Undecane	ug/m3	6.4 U	0.44 J	1.5 J	0.50 J	6.4 U [6.4 U]	16 U	6.4 U	4.7 J	6.2 J
o-Xylene	ug/m3	0.87 U	1.2	0.87 U	0.87 U	0.87 U [0.91]	2.2 U	1.1	5.2	2.3
Pentane	ug/m3	3.5	13	1.3 J	3.2	3.9 [5.7]	3.2 J	6.4	1.8 J	4.4
tert-Butyl Alcohol	ug/m3	6.1 U	6.1 U	6.1 U	6.1 U	6.1 U [6.1 U]	15 U	6.1 U	6.1 U	2.8 J
Tetrachloroethene	ug/m3	1.4 U	1.4 U	56	360	59 [62]	1,000	62	29	310
Toluene	ug/m3	4.2	8.6	1.2	2.7	2.9 J [6.7 J]	3.7	4.4	8.7	5.3
Trichloroethene	ug/m3	1.1 U	1.1 U	1.1 U	0.80 J	1.1 U [1.1 U]	2.7 U	3.2	1.1 U	3.8
Trichlorofluoromethane	ug/m3	1.8	2.7	5.3	1.9	2.0 [1.9]	2.8	4.2	5.7	15
Vinyl Chloride	ug/m3	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U [0.51 U]	1.3 U	0.51 U	0.51 U	0.63

See notes on Page 3.

TABLE 9

SUMMARY OF AMBIENT AIR AND SOIL-GAS ANALYTICAL RESULTS FOR DETECTED VOCs (ug/m3) - 2009

NATIONAL GRID

ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE

SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by ARCADIS of New York, Inc. on the dates indicated.
2. VOCs = Volatile Organic Compounds.
3. Samples were analyzed by TestAmerica, Knoxville, TN for total VOCs in soil vapor following United States Environmental Protection Agency (USEPA) Method TO-15.
4. Only those constituents detected in one or more samples are summarized.
5. Concentrations reported in micrograms per cubic meter (ug/m ^{3}).
6. Data qualifiers are defined as follows:

   U = Constituent not detected at a concentration above the reported detection limit.

   J = The compound was positively identified; however the associated numerical value is an estimated concentration only.

   D = Concentration is based on a diluted sample analysis.

   UJ = The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.

TABLE 10
SUBSLAB AND OUTDOOR AMBIENT AIR ANALYTICAL RESUTLS FOR DETECTED VOCS (ug/m^3)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID: / Date Collected:	USEPA 90th Percentile Background Indoor Air Level	NYSDOH Air Guideline Values	Units	AMB 03/01/11	VP-1 03/01/11	VP-2 03/01/11	VP-3 03/01/11	VP-4 03/01/11
Detected VOCs								
1,1,1-Trichloroethane	20.6	--	ug/m^3	1.1 U	0.75 J	1.6 [1.6]	0.38 J	0.80 J
1,1,2-Trichloro-1,2,2-trifluoroethane	3.5	--	ug/m^3	0.62 J	1.3 J	0.67 J [0.61 J]	0.63 J	0.63 J
1,2,4-Trimethylbenzene	9.5	--	ug/m^3	0.98 U	1.2	0.98 U [0.98 U]	1.4	1.2
1,2-Dichlorobenzene	ND (< 1.2)	--	ug/m^3	1.2 U	2.9	1.2 U [1.2 U]	1.2 U	1.2 U
1,3,5-Trimethylbenzene	3.7	--	ug/m^3	0.98 U	0.41 J	0.98 U [0.98 U]	0.52 J	0.35 J
1,4-Dichlorobenzene	5.5	--	ug/m^3	1.2 U	1.4	1.2 U [1.2 U]	1.2 U	1.2 U
2,2,4-Trimethylpentane	--	--	ug/m^3	0.50 J	0.44 J	2.3 U [2.3 U]	0.64 J	0.40 J
2-Butanone	12	--	ug/m^3	0.88 J	2.3 J	2.9 U [0.84 J]	3.7	2.3 J
2-Hexanone	--	--	ug/m^3	2.0 U	0.45 J	2.0 U [2.0 U]	0.86 J	0.38 J
4-Ethyltoluene	3.6	--	ug/m^3	2.0 U	2.0 U	2.0 U [2.0 U]	0.39 J	2.0 U
4-Methyl-2-pentanone	6.0	--	ug/m^3	2.0 U	0.24 J	2.0 U [2.0 U]	0.34 J	2.0 U
Acetone	98.9	--	ug/m^3	3.6 J	11 J	12 U [3.7 J]	22	19
Benzene	9.4	--	ug/m^3	0.89	0.70	0.20 J [0.64 U]	0.99	0.50 J
Carbon Disulfide	4.2	--	ug/m^3	1.6 U	0.97 J	0.18 J [0.16 J]	0.60 J	1.4 J
Carbon Tetrachloride	ND (< 1.3)	--	ug/m^3	0.66 J	0.94 J	1.1 J [0.98 J]	4.1 J	0.40 J
Chlorobenzene	ND (< 0.9)	--	ug/m^3	0.92 U	2.7	0.51 J [0.92 U]	0.33 J	0.27 J
Chloroform	1.1	--	ug/m^3	0.98 U	0.59 J	4.5 [4.5]	9.7	2.2
Chloromethane	3.7	--	ug/m^3	1.4	1.0 U	1.0 U [1.0 U]	0.85 J	1.0 U
cis-1,2-Dichloroethene	ND (<1.9)	--	ug/m^3	0.79 U	0.74 J	0.79 U [0.79 U]	0.79 U	0.79 U
Cyclohexane	--	--	ug/m^3	0.45 J	0.23 J	0.81 J [0.74 J]	1.6 J	0.48 J
Dichlorodifluoromethane	16.5	--	ug/m^3	2.8	3.0	3.0 [3.0]	3.0	3.3
Ethanol	210	--	ug/m^3	3.8 U	3.8 U	3.8 U [3.8 U]	5.0	8.5
Ethylbenzene	5.7	--	ug/m^3	0.35 J	0.45 J	0.87 U [0.87 U]	0.86	0.49 J
Isopropyl Alcohol	250	--	ug/m^3	2.2 J	1.3 J	0.31 J [0.70 J]	3.9 J	2.4 J
m,p-Xylene	22.2	--	ug/m^3	0.27	0.40	0.14 J [0.15 J]	0.71	0.44
Methylene Chloride	10	60	ug/m^3	0.88 J	1.3 J	0.97 J [0.95 J]	3.5	8.1
Naphthalene	5.1	--	ug/m^3	2.6 U	2.6 U	2.6 U [0.49 J]	2.6 U	0.55 J
n-Butane	--	--	ug/m^3	6.3	0.55 J	0.98 [1.2]	17	5.6
n-Decane	17.5	--	ug/m^3	5.8 U	1.9 J	0.96 J [0.83 J]	1.8 J	1.8 J
n-Dodecane	15.9	--	ug/m^3	7.0 U	7.0 U	7.0 U [7.0 U]	7.0 U	0.81 J
n-Heptane	--	--	ug/m^3	0.39 J	0.71 J	0.28 J [0.32 J]	1.2 J	0.37 J

TABLE 10
SUBSLAB AND OUTDOOR AMBIENT AIR ANALYTICAL RESUTLS FOR DETECTED VOCS (ug/m^3)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID: Date Collected:	USEPA 90th Percentile Background Indoor Air Level	NYSDOH Air Guideline Values	Units	AMB 03/01/11	VP-1 03/01/11	VP-2 03/01/11	VP-3 03/01/11	VP-4 03/01/11
n-Hexane	10.2	--	ug/m^3	1.1 J	0.43 J	0.38 J [0.45 J]	1.7 J	0.82 J
n-Octane	4.5	--	ug/m^3	1.9 U	0.37 J	0.21 J [0.24 J]	0.56 J	0.27 J
Nonane	7.8	--	ug/m^3	2.6 U	0.57 J	2.6 U [2.6 U]	0.87 J	2.6 U
n-Undecane	22.6	--	ug/m^3	6.4 U	1.4 J	0.54 J [6.4 U]	1.2 J	1.6 J
o-Xylene	7.9	--	ug/m^3	0.41 J	0.55 J	0.33 J [0.32 J]	0.95	0.67 J
Pentane	--	--	ug/m^3	3.9	3.0 U	0.57 J [0.83 J]	4.0	1.8 J
Styrene	1.9	--	ug/m^3	0.85 U	0.85 U	0.85 U [0.85 U]	0.28 J	0.85 U
tert-Butyl Alcohol	--	--	ug/m^3	0.14 J	0.52 J	0.14 J [0.23 J]	0.65 J	0.35 J
Tetrachloroethene	15.9	100	ug/m^3	1.6	4.6	2.7 [3.5]	0.73 J	3.5
Toluene	43	--	ug/m^3	1.6	2.4	0.93 [0.98]	5.1	2.1
Trichloroethene	4.2	5	ug/m^3	0.70 J	16	2.1 [0.76 J]	1.4	0.94 J
Trichlorofluoromethane	18.1	--	ug/m^3	1.5	3.1	1.7 [1.8]	2.8	2.7
Detected Miscellaneous								
Helium	--	10	%	NA	0.180 U	0.190 U [0.180 U]	0.180 U	0.720

TABLE 10
SUBSLAB AND OUTDOOR AMBIENT AIR ANALYTICAL RESUTLS FOR DETECTED VOCS (ug/m3)

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples collected by ARCADIS on the dates indicated.
2. Samples analyzed by TestAmerica, Inc. of Knoxville, Tennessee.
3. Analysis was performed using United States Environmental Protection Agency (USEPA) Compendium Method TO-15. NYSDEC DER TO-15 TCL = New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) Target Compound List (TCL) as presented in the February 2008 "NYSDEC Modifications to EPA Region 9 TO-15 QA/QC Criteria."
4. Sample designations indicate the following:
   - VP = Subslab soil vapor sample point.
   - AMB = Ambient (outdoor) air sample.
5. Concentrations for VOC constituents are reported in micrograms per cubic meter ($\mu g/m^3$).
6. Field duplicate sample results are presented in brackets.
7. USEPA 90th Percentile Background Indoor Air Levels are the 90th percentile of background indoor air values observed by the United States Environmental Protection Agency (USEPA) in a study of public and commercial office buildings, per USEPA database information referenced in Section 3.2.4 of the "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (NYSDOH, October 2006) (NYSDOH SVI Guidance Document).
8. NYSDOH Air Guideline Values are from Table 3.1 of the NYSDOH SVI Guidance Document.
9. U = Not detected above the associated reporting limit. The listed value is the associated reporting limit.
10. J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
11. -- = The compound was not surveyed as part of the USEPA Background Indoor Air study or listed in the NYSDOH SVI Guidance.
12. ND (<1.9) = The compound was not detected above the associated reporting limit as part of the USEPA Background Indoor Air Study. The listed value is the associated reporting limit.
13. The results have been validated by ARCADIS.

TABLE 11
MONITORING WELL CONSTRUCTION SUMMARY

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Monitoring Well ID	General Location	Installation Date	Northing Coordinate	Easting Coordinate	Ground Surface Elevation	Measuring Point Elevation	Well Diameter	Casing Type	Screen Slot Size	Screen Length	Elevation of Screened Interval ft., NAVD 88		Depth to Screened Interval ft. bgs		Sump Length	Well Total Depth	Estimated Hydraulic Conductivity		Comments
			ft.	ft.	88	88	in.		in.	ft.	Top	m	Top	m	ft.	ft. bgs	cm/sec	ft/day	
MW-5	Grand Street (west of Trinity Substation)	6/8/04	1388896.17	691578.22	55.81	55.49	2	PVC	0.01	10	25.8	15.81	30	40	2	42	######	2.3E-02	Specific capacity test
MW-6	Trinity Substation	6/23/04	1388727.25	691655.85	38.46	37.94	2	PVC	0.01	10	30.5	20.46	8	18	2	20	######	1.3E+01	Specific capacity test
MW-7	Trinity Substation	6/14/04	1388823.72	691823.02	37.70	37.40	2	PVC	0.01	10	20.70	10.70	17	27	2	29	######	2.1E+00	Specific capacity test
MW-8A	Trinity Place (near Arch	6/16/09	1388512.40	691750.51	25.85	25.26	2	PVC	0.01	15	15.9	0.85	10	25	0	25	- -	- -	- -
MW-9	Trinity Substation	5/12/05	1388699.12	691583.88	40.51	40.03	2	PVC	0.01	10	34.5	24.51	6	16	2	18	######	2.9E-02	Specific capacity test
MW-10	Trinity Substation	5/11/05	1388622.58	691719.56	37.28	36.91	2	PVC	0.01	10	25.3	15.28	12	22	2	24	1.7E-05	4.9E-02	Cooper-Jacob
MW-14	Grand Street	9/8/05	1388999.66	691563.37	60.03	59.34	2	PVC	0.01	10	48	38.03	12	22	0	22	######	6.0E-02	Cooper-Jacob

Notes:
1. ft = feet
2. in = inches
3. NAVD 88 = elevations in feet above mean sea level, referenced to the North American Vertical Datum of 1988.
4. bgs = below ground surface
5. PVC = polyvinyl chloride
6. - - = No data is available
7. The Cooper-Jacob calculations were made using the data obtained during the sampling.

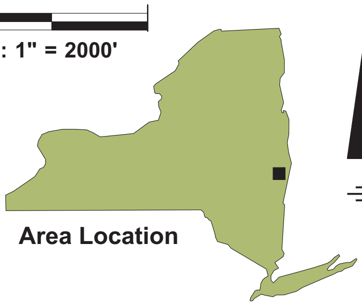
ARCADIS

Figures

REFERENCE: Figure obtained from 3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS portions of Albany, Troy South, Delmar, and East Greenbush Quadrangle.

2000' 0 2000'

Approximate Scale: 1" = 2000'



Area Location

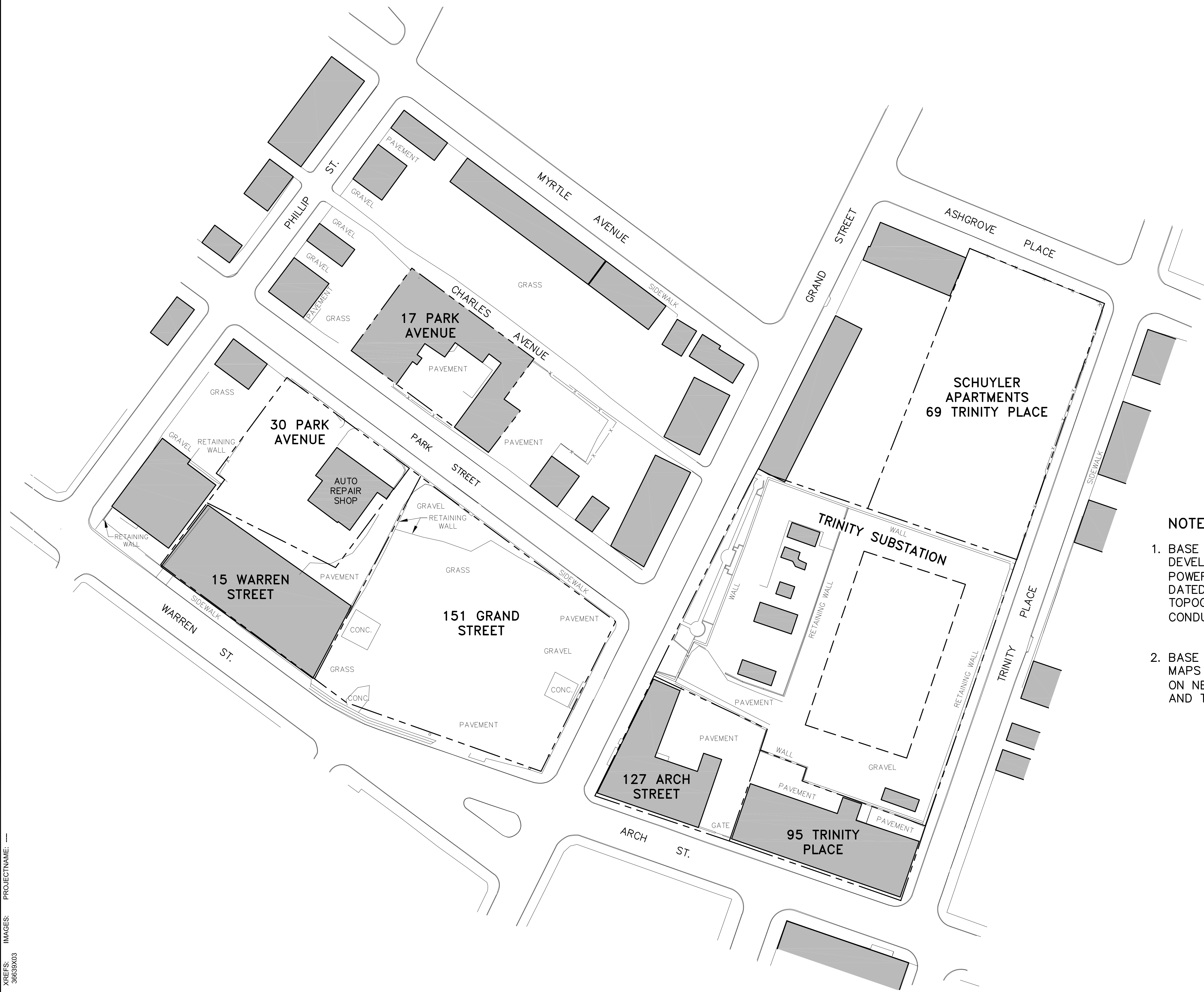
NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

SITE LOCATION MAP

ARCADIS

FIGURE
1

02/24/2012 SYRACUSE, NY-ENV/CAD-DJHOWES
B0036639/0000/00015/CDR/36639N02.CDR



LEGEND:

- BUILDING/STRUCTURE
- FENCE
- APPROXIMATE PROPERTY LINE

NOTES:

1. BASE MAP (INCLUDING BUILDING AND UTILITY LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–5259–E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 2004.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

SITE LAYOUT

ARCADIS

FIGURE
2

LEGEND:

MW-8A ⊕	MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
MW-7	MONITORING WELL LOCATION
SS-8 △	SURFACE SOIL SAMPLE LOCATION
SB-10 ▲	SOIL BORING LOCATION
TP-4	TEST PIT LOCATION
SG-101 △	PERMANENT SOIL-GAS SAMPLING LOCATION
SG-108T △	TEMPORARY SOIL-GAS SAMPLING LOCATION
AA-1	AMBIENT AIR SAMPLE LOCATION
	BUILDING/STRUCTURE
—x—x—	FENCE
— — —	APPROXIMATE PROPERTY LINE
	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 2004.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
4. LOCATIONS OF SOIL BORINGS SB-11, SB-12, AND SB-13 ARE APPROXIMATE.
5. LOCATIONS SOIL GAS WELLS SG-1, SG-2, SG-3, SG-5, AND SG-6 ARE APPROXIMATE.

0 100' 200'

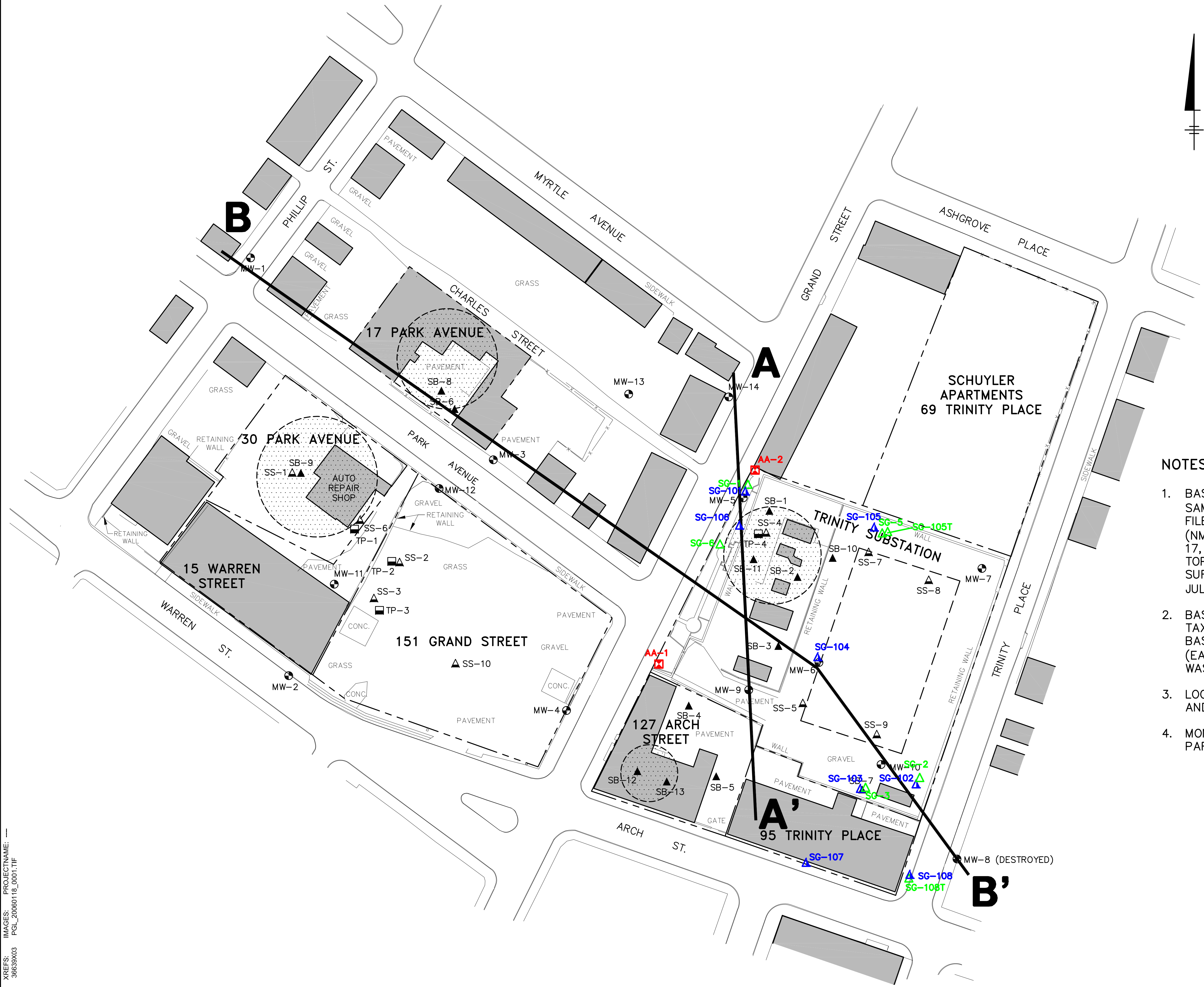
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

HISTORICAL MGP STRUCTURES AND SAMPLING LOCATIONS

ARCADIS

FIGURE
3



LEGEND:

- MW-7 — MONITORING WELL LOCATION
- SS-8 — SURFACE SOIL SAMPLE LOCATION
- SB-10 — SOIL BORING LOCATION
- TP-4 — TEST PIT LOCATION
- SG-101 — PERMANENT SOIL-GAS SAMPLING LOCATION
- SG-108T — TEMPORARY SOIL-GAS SAMPLING LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- BUILDING/STRUCTURE
- FENCE
- APPROXIMATE PROPERTY LINE
- APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
- A-A' — CROSS-SECTION LOCATION

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NATIONAL GRID DURING JULY/AUGUST 2004 AND DECEMBER 2005.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. LOCATIONS OF SOIL BORINGS SB-10, SB-11, SB-12 AND SB-13 ARE APROXIMATE.
4. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

CROSS-SECTION LOCATION MAP

ARCADIS

FIGURE
4

CITY:SYRACUSE DIV/GROUP:ENVCAD DB:R. BASSETT LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0036639\0000\00015\DWG\SMP\36639B03.DWG LAYOUT: 4 SAVED: 2/24/2012 12:21 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/24/2012 12:21 PM BY: BASSETT, RICHARD
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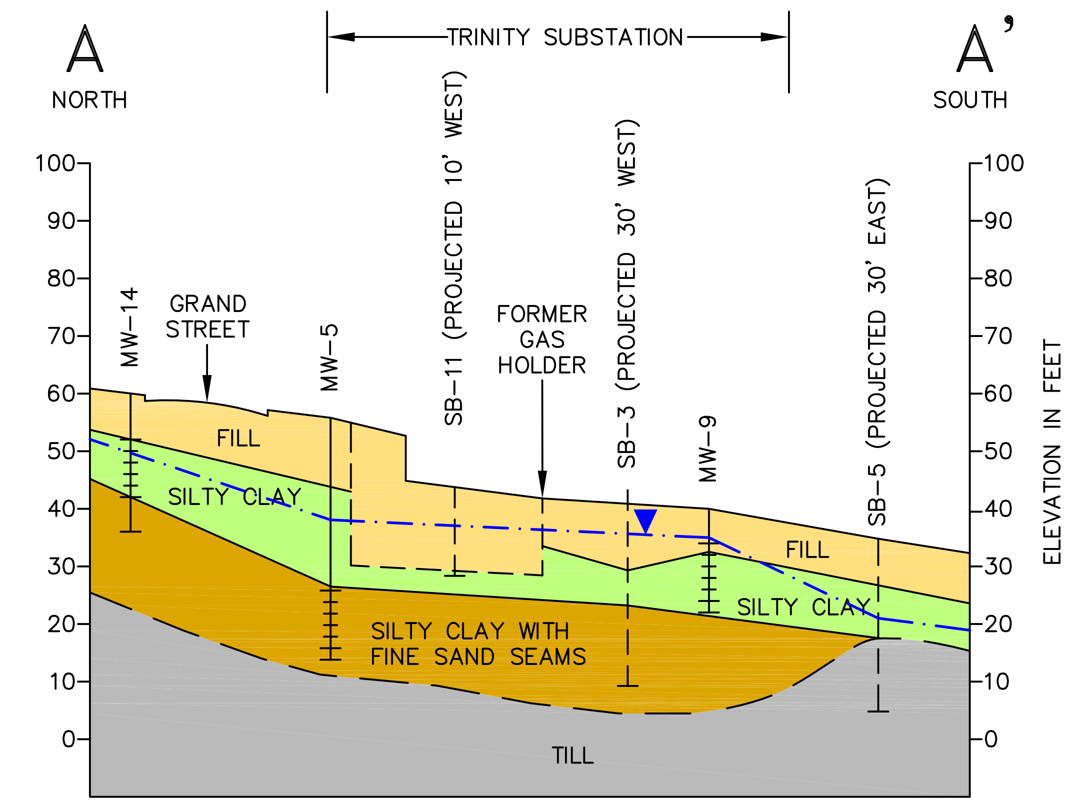
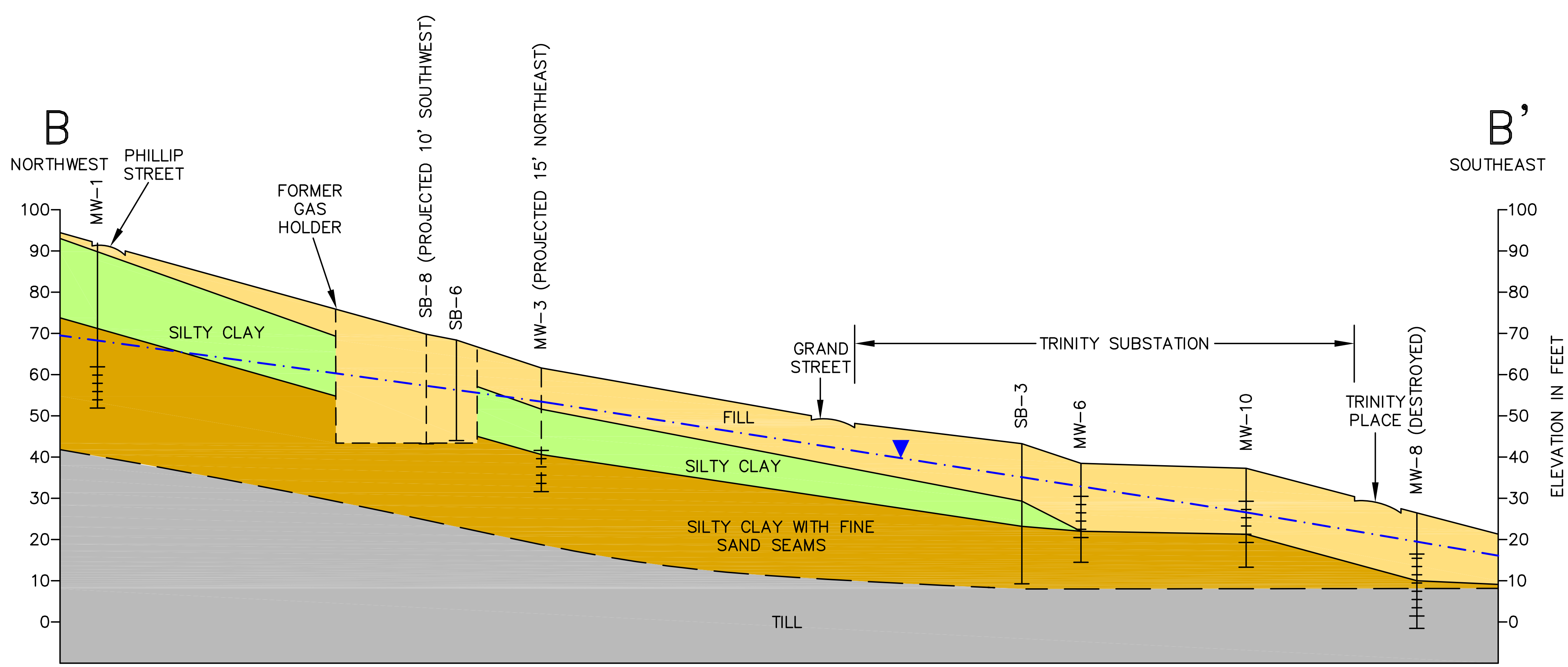




LEGEND:

- MW-6 — SOIL BORING ID
- SCREENED INTERVAL
- BOTTOM OF BORING
- GROUNDWATER ELEVATION (10/25/05)
- GEOLOGIC CONTACT
- INFERRED GEOLOGIC CONTACT
- FILL
- SILTY CLAY
- SILTY CLAY WITH FINE SAND SEAMS
- TILL

NOTES:

1. ELEVATIONS REFRENCED TO THE NORTH AMERICA VERTICAL DATUM OF 1988 (NAVD 88).
2. LOCATIONS OF SOIL BORINGS SB-10, SB-11, SB-12 AND SB-13 ARE APROXIMATE.
3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.

0 100' 200'
HORIZONTAL GRAPHIC SCALE

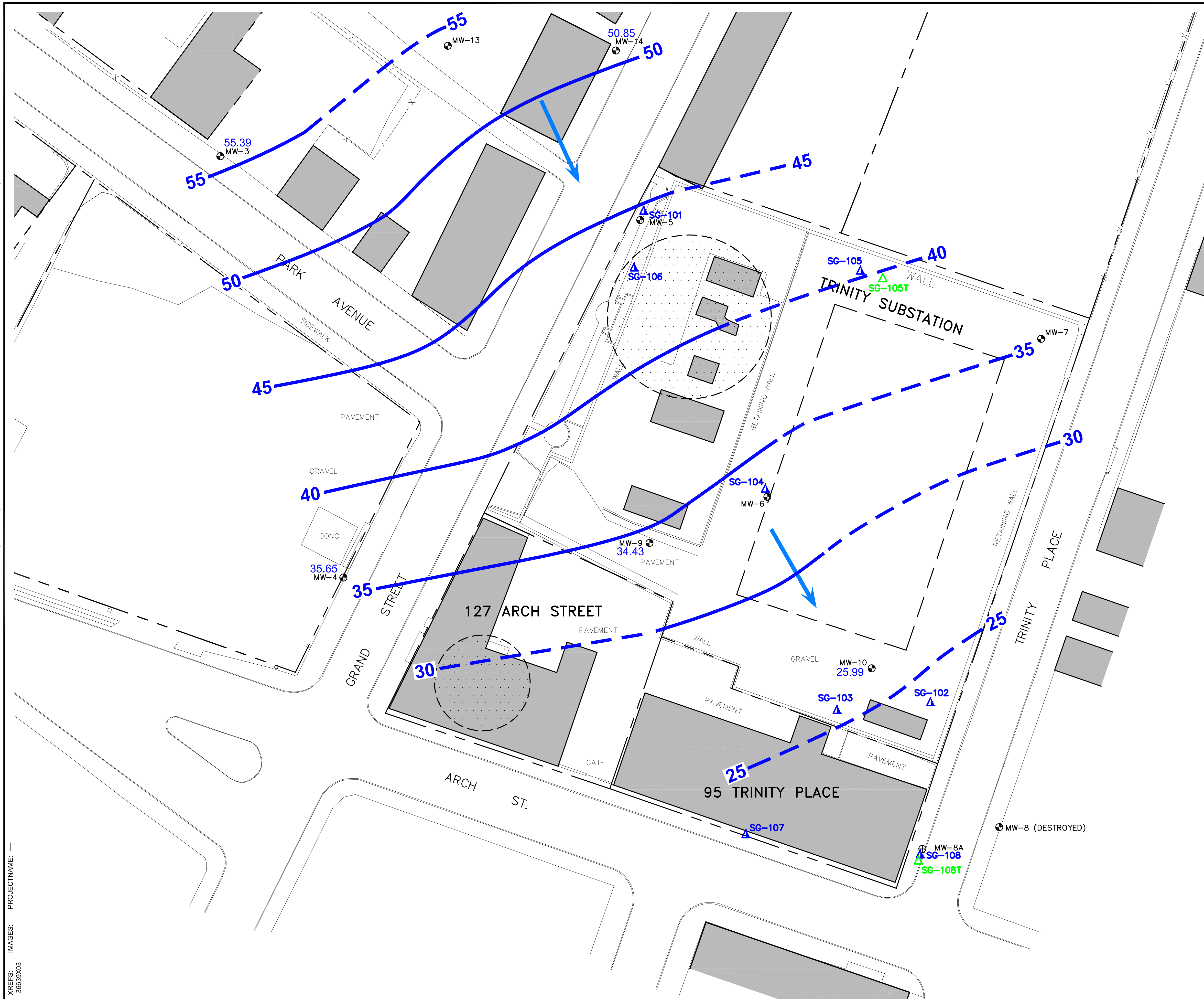
0 30' 60'
VERTICAL GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

GENERALIZED GEOLOGIC CROSS-SECTIONS A-A' AND B-B'

ARCADIS

FIGURE
5



LEGEND:

MW-8A ⊕	MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
MW-7	MONITORING WELL LOCATION
SG-101 △	PERMANENT SOIL-GAS SAMPLING LOCATION
SG-108T △	TEMPORARY SOIL GAS SAMPLING POINT
	BUILDING/STRUCTURE
—x—x—	FENCE
— — —	APPROXIMATE PROPERTY LINE
	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
34.43	SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE ELEVATION IN FEET, ABOVE MEAN SEA LEVEL (FT, AMSL)
35 ——	SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE ELEVATION CONTOUR (FT, AMSL) (DASHED WHERE INFERRED)
←	DIRECTION OF GROUNDWATER FLOW

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NATIONAL GRID DURING JULY/AUGUST 2004 AND DECEMBER 2005.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.

0 60' 120'

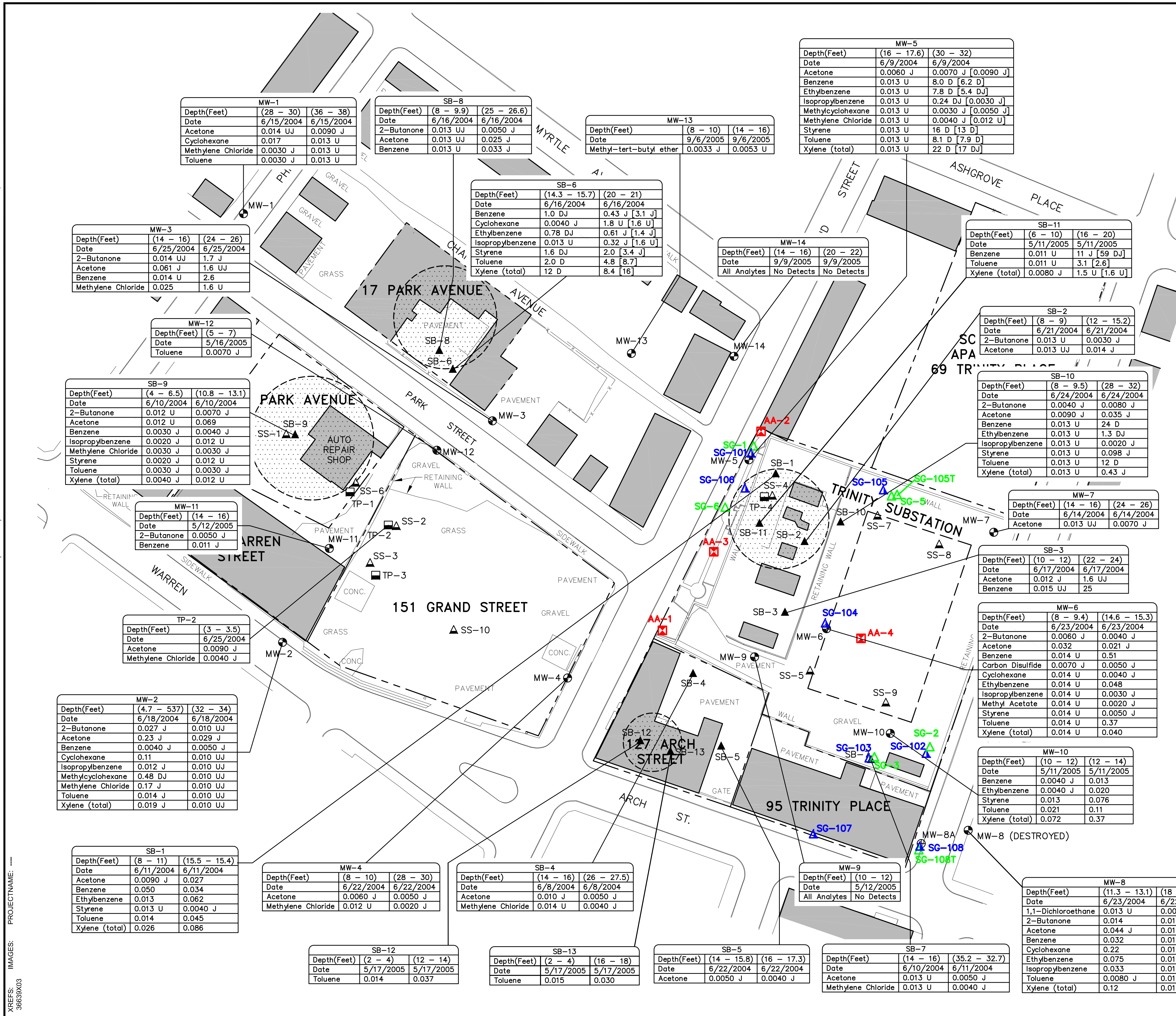
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR MAP - JUNE 2009

ARCADIS

FIGURE
6



MW-1		
Depth(Feet)	(28 – 30)	(36 – 38)
Date	6/15/2004	6/15/2004
Acetone	0.014 UJ	0.0090 J
Cyclohexane	0.017	0.013 U
Methylene Chloride	0.0030 J	0.013 U
Toluene	0.0030 J	0.013 U

SB-8		
Depth(Feet)	(8 – 9.9)	(25 – 26.6)
Date	6/16/2004	6/16/2004
2-Butanone	0.013 UJ	0.0050 J
Acetone	0.013 UJ	0.025 J
Benzene	0.013 U	0.033 J

MW-13		
Depth(Feet)	(8 – 10)	(14 – 16)
Date	9/6/2005	9/6/2005
Methyl-tert-butyl ether	0.0033 J	0.0053 U

MW-5		
Depth(Feet)	(16 – 17.6)	(30 – 32)
Date	6/9/2004	6/9/2004
Acetone	0.0060 J	0.0070 J [0.0090 J]
Benzene	0.013 U	8.0 D [6.2 D]
Ethylbenzene	0.013 U	7.8 D [5.4 DJ]
Isopropylbenzene	0.013 U	0.24 DJ [0.0030 J]
Methylcyclohexane	0.013 U	0.0030 J [0.0050 J]
Methylene Chloride	0.013 U	0.0040 J [0.012 U]
Styrene	0.013 U	16 D [13 D]
Toluene	0.013 U	8.1 D [7.9 D]
Xylene (total)	0.013 U	22 D [17 DJ]

MW-3		
Depth(Feet)	(14 – 16)	(24 – 26)
Date	6/25/2004	6/25/2004
2-Butanone	0.014 UJ	1.7 J
Acetone	0.061 J	1.6 UJ
Benzene	0.014 U	2.6
Methylene Chloride	0.025	1.6 U

SB-6		
Depth(Feet)	(14.3 – 15.7)	(20 – 21)
Date	6/16/2004	6/16/2004
Benzene	1.0 DJ	0.43 J [3.1 J]
Cyclohexane	0.0040 J	1.8 U [1.6 U]
Ethylbenzene	0.78 DJ	0.61 J [1.4 J]
Isopropylbenzene	0.013 U	0.32 J [1.6 U]
Styrene	1.6 DJ	2.0 [3.4 J]
Toluene	2.0 D	4.8 [8.7]
Xylene (total)	12 D	8.4 [16]

MW-14		
Depth(Feet)	(14 – 16)	(20 – 22)
Date	9/9/2005	9/9/2005
All Analytes	No Detects	No Detects

SB-11		
Depth(Feet)	(6 – 10)	(16 – 20)
Date	5/11/2005	5/11/2005
Benzene	0.011 U	11 J [59 DJ]
Toluene	0.011 U	3.1 [2.6]
Xylene (total)	0.0080 J	1.5 U [1.6 U]

MW-12	
Depth(Feet)	(5 – 7)
Date	5/16/2005
Toluene	0.0070 J

SB-2		
Depth(Feet)	(8 – 9)	(12 – 15.2)
Date	6/21/2004	6/21/2004
2-Butanone	0.013 U	0.0030 J
Acetone	0.013 UJ	0.014 J

SB-9		
Depth(Feet)	(4 – 6.5)	(10.8 – 13.1)
Date	6/10/2004	6/10/2004
2-Butanone	0.012 U	0.0070 J
Acetone	0.012 U	0.069
Benzene	0.0030 J	0.0040 J
Isopropylbenzene	0.0020 J	0.012 U
Methylene Chloride	0.0030 J	0.0030 J
Styrene	0.0020 J	0.012 U
Toluene	0.0030 J	0.0030 J
Xylene (total)	0.0040 J	0.012 U

SB-10		
Depth(Feet)	(8 – 9.5)	(28 – 32)
Date	6/24/2004	6/24/2004
2-Butanone	0.0040 J	0.0080 J
Acetone	0.0090 J	0.035 J
Benzene	0.013 U	24 D
Ethylbenzene	0.013 U	1.3 DJ
Isopropylbenzene	0.013 U	0.0020 J
Styrene	0.013 U	0.098 J
Toluene	0.013 U	12 D
Xylene (total)	0.013 U	0.43 J

MW-7		
Depth(Feet)	(14 – 16)	(24 – 26)
Date	6/14/2004	6/14/2004
Acetone	0.013 UJ	0.0070 J

MW-11	
Depth(Feet)	(14 – 16)
Date	5/12/2005
2-Butanone	0.0050 J
Benzene	0.011 J

SB-3		
Depth(Feet)	(10 – 12)	(22 – 24)
Date	6/17/2004	6/17/2004
Acetone	0.012 J	1.6 UJ
Benzene	0.015 UJ	25

TP-2	
Depth(Feet)	(3 – 3.5)
Date	6/25/2004
Acetone	0.0090 J
Methylene Chloride	0.0040 J

MW-6		
Depth(Feet)	(8 – 9.4)	(14.6 – 15.3)
Date	6/23/2004	6/23/2004
2-Butanone	0.0060 J	0.0040 J
Acetone	0.032	0.021 J
Benzene	0.014 U	0.51
Carbon Disulfide	0.0070 J	0.0050 J
Cyclohexane	0.014 U	0.0040 J
Ethylbenzene	0.014 U	0.048
Isopropylbenzene	0.014 U	0.0030 J
Methyl Acetate	0.014 U	0.0020 J
Styrene	0.014 U	0.0050 J
Toluene	0.014 U	0.37
Xylene (total)	0.014 U	0.040

MW-2		
Depth(Feet)	(4.7 – 537)	(32 – 34)
Date	6/18/2004	6/18/2004
2-Butanone	0.027 J	0.010 UJ
Acetone	0.23 J	0.029 J
Benzene	0.0040 J	0.0050 J
Cyclohexane	0.11	0.010 UJ
Isopropylbenzene	0.012 J	0.010 UJ
Methylcyclohexane	0.48 DJ	0.010 UJ
Methylene Chloride	0.17 J	0.010 UJ
Toluene	0.014 J	0.010 UJ
Xylene (total)	0.019 J	0.010 UJ

MW-10		
Depth(Feet)	(10 – 12)	(12 – 14)
Date	5/11/2005	5/11/2005
Benzene	0.0040 J	0.013
Ethylbenzene	0.0040 J	0.020
Styrene	0.013	0.076
Toluene	0.021	0.11
Xylene (total)	0.072	0.37

SB-1		
Depth(Feet)	(8 – 11)	(15.5 – 15.4)
Date	6/11/2004	6/11/2004
Acetone	0.0090 J	0.027
Benzene	0.050	0.034
Ethylbenzene	0.013	0.062
Styrene	0.013 U	0.0040 J
Toluene	0.014	0.045
Xylene (total)	0.026	0.086

MW-4		
Depth(Feet)	(8 – 10)	(28 – 30)
Date	6/22/2004	6/22/2004
Acetone	0.0060 J	0.0050 J
Methylene Chloride	0.012 U	0.0020 J

SB-4		
Depth(Feet)	(14 – 16)	(26 – 27.5)
Date	6/8/2004	6/8/2004
Acetone	0.010 J	0.0050 J
Methylene Chloride	0.014 U	0.0040 J

MW-9	
Depth(Feet)	(10 – 12)
Date	5/12/2005
All Analytes	No Detects

MW-8		
Depth(Feet)	(11.3 – 13.1)	(18 – 20)
Date	6/23/2004	6/22/2004
1,1-Dichloroethane	0.013 U	0.0030 J
2-Butanone	0.014	0.012 U
Acetone	0.044 J	0.012 UJ
Benzene	0.032	0.012 U
Cyclohexane	0.22	0.012 U
Ethylbenzene	0.075	0.012 U
Isopropylbenzene	0.033	0.012 U
Toluene	0.0080 J	0.012 U
Xylene (total)	0.12	0.012 U

SB-12		
Depth(Feet)	(2 – 4)	(12 – 14)
Date	5/17/2005	5/17/2005
Toluene	0.014	0.037

SB-13		
Depth(Feet)	(2 – 4)	(16 – 18)
Date	5/17/2005	5/17/2005
Toluene	0.015	0.030

SB-5		
Depth(Feet)	(14 – 15.8)	(16 – 17.3)
Date	6/22/2004	6/22/2004
Acetone	0.0050 J	0.0040 J

SB-7		
Depth(Feet)	(14 – 16)	(35.2 – 32.7)
Date	6/10/2004	6/11/2004
Acetone	0.013 U	0.0050 J
Methylene Chloride	0.013 U	0.0040 J

LEGEND:

- MW-8A — MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
- MW-7 — MONITORING WELL LOCATION
- SS-8 — SURFACE SOIL SAMPLE LOCATION
- SB-10 — SOIL BORING LOCATION
- TP-4 — TEST PIT LOCATION
- SG-101 — PERMANENT SOIL-GAS SAMPLING LOCATION
- SG-108T — TEMPORARY SOIL-GAS SAMPLING LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- BUILDING/STRUCTURE
- —x—x— FENCE
- APPROXIMATE PROPERTY LINE
- APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 2004.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
4. LOCATIONS OF SOIL BORINGS SB-11, SB-12, AND SB-13 ARE APPROXIMATE.
5. LOCATIONS SOIL GAS WELLS SG-1, SG-2, SG-3, SG-5, AND SG-6 ARE APPROXIMATE.
6. U = CONSTITUENT NOT DETECTED AT A CONCENTRATION ABOVE THE REPORTED DETECTION LIMIT.
   UJ = THE COMPOUND WAS NOT DETECTED ABOVE THE REPORTED SAMPLE QUANTITATION LIMIT. HOWEVER, THE REPORTED LIMIT IS APPROXIMATE AND MAY OR MAY NOT REPRESENT THE ACTUAL LIMIT OF QUANTITATION.
   D = CONCENTRATION IS BASED ON A DILUTED SAMPLE ANALYSIS.
   J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

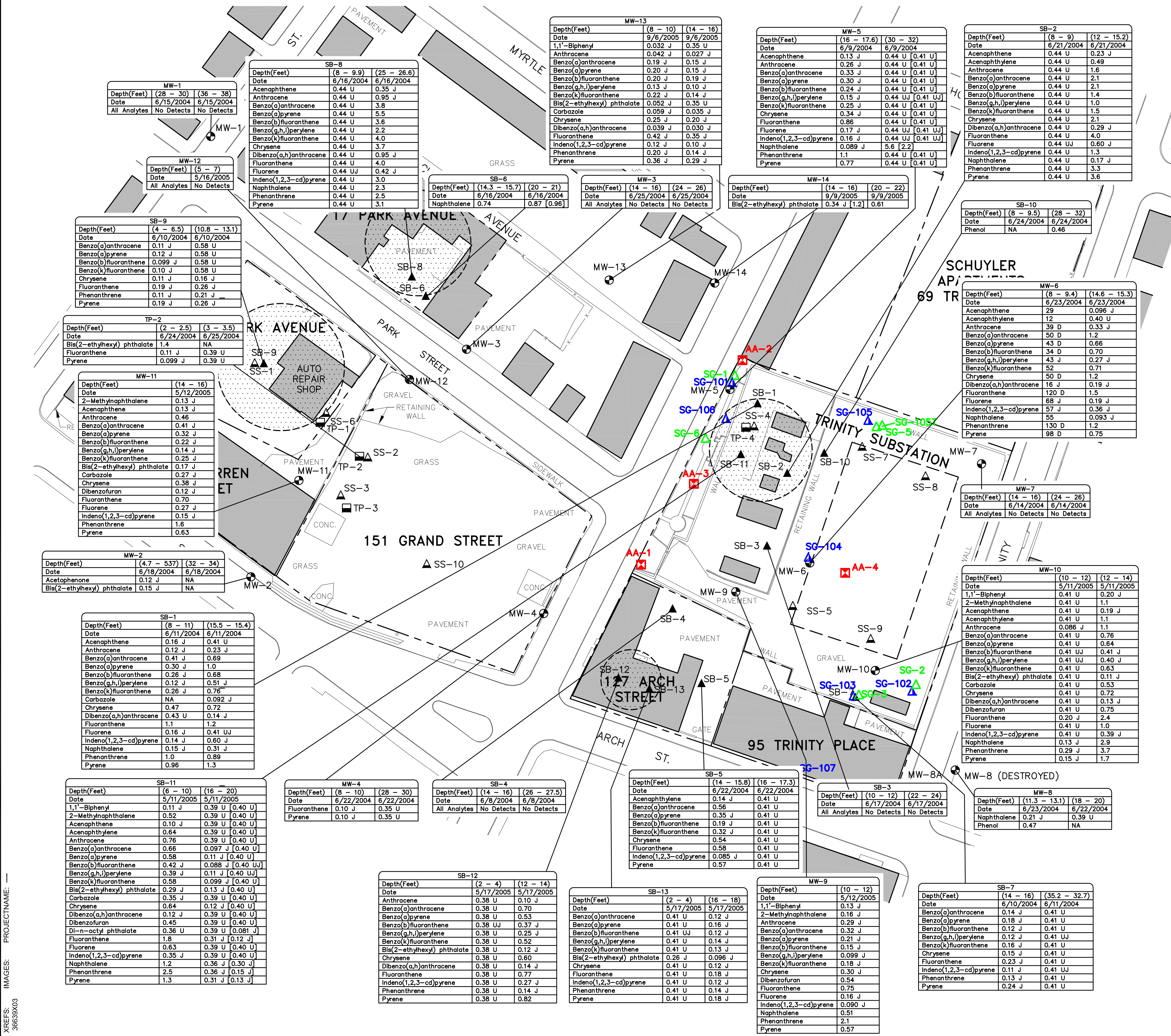
0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

DETECTED VOC CONCENTRATIONS IN SOIL (ppm)

ARCADIS

FIGURE
7



MW-1		
Depth(Feet)	(28 – 30)	(36 – 38)
Date	6/15/2004	6/15/2004
All Analytes	No Detects	No Detects

SB-8		
Depth(Feet)	(8 – 9.9)	(25 – 26.6)
Date	6/16/2004	6/16/2004
Acenaphthene	0.44 U	0.35 J
Anthracene	0.44 U	0.95 J
Benzo(a)anthracene	0.44 U	3.8
Benzo(a)pyrene	0.44 U	5.5
Benzo(b)fluoranthene	0.44 U	3.6
Benzo(g,h,i)perylene	0.44 U	2.2
Benzo(k)fluoranthene	0.44 U	4.0
Chrysene	0.44 U	3.7
Dibenzo(a,h)anthracene	0.44 U	0.95 J
Fluoranthene	0.44 U	4.0
Fluorene	0.44 UJ	0.42 J
Indeno(1,2,3-cd)pyrene	0.44 U	3.0
Naphthalene	0.44 U	2.3
Phenanthrene	0.44 U	2.5
Pyrene	0.44 U	3.1

MW-13		
Depth(Feet)	(8 – 10)	(14 – 16)
Date	9/6/2005	9/6/2005
1,1'-Biphenyl	0.032 J	0.35 U
Anthracene	0.042 J	0.027 J
Benzo(a)anthracene	0.19 J	0.15 J
Benzo(a)pyrene	0.20 J	0.15 J
Benzo(b)fluoranthene	0.20 J	0.19 J
Benzo(g,h,i)perylene	0.13 J	0.10 J
Benzo(k)fluoranthene	0.22 J	0.14 J
Bis(2-ethylhexyl) phthalate	0.052 J	0.35 U
Carbazole	0.059 J	0.035 J
Chrysene	0.25 J	0.20 J
Dibenzo(a,h)anthracene	0.039 J	0.030 J
Fluoranthene	0.42 J	0.35 J
Indeno(1,2,3-cd)pyrene	0.12 J	0.10 J
Phenanthrene	0.20 J	0.14 J
Pyrene	0.36 J	0.29 J

MW-5		
Depth(Feet)	(16 – 17.6)	(30 – 32)
Date	6/9/2004	6/9/2004
Acenaphthene	0.13 J	0.44 U [0.41 U]
Anthracene	0.26 J	0.44 U [0.41 U]
Benzo(a)anthracene	0.33 J	0.44 U [0.41 U]
Benzo(a)pyrene	0.30 J	0.44 U [0.41 U]
Benzo(b)fluoranthene	0.24 J	0.44 U [0.41 U]
Benzo(g,h,i)perylene	0.15 J	0.44 UJ [0.41 UJ]
Benzo(k)fluoranthene	0.25 J	0.44 U [0.41 U]
Chrysene	0.34 J	0.44 U [0.41 U]
Fluoranthene	0.86	0.44 U [0.41 U]
Fluorene	0.17 J	0.44 UJ [0.41 UJ]
Indeno(1,2,3-cd)pyrene	0.16 J	0.44 UJ [0.41 UJ]
Naphthalene	0.089 J	5.6 [2.2]
Phenanthrene	1.1	0.44 U [0.41 U]
Pyrene	0.77	0.44 U [0.41 U]

SB-2		
Depth(Feet)	(8 – 9)	(12 – 15.2)
Date	6/21/2004	6/21/2004
Acenaphthene	0.44 U	0.23 J
Acenaphthylene	0.44 U	0.49
Anthracene	0.44 U	1.6
Benzo(a)anthracene	0.44 U	2.1
Benzo(a)pyrene	0.44 U	2.1
Benzo(b)fluoranthene	0.44 U	1.4
Benzo(g,h,i)perylene	0.44 U	1.0
Benzo(k)fluoranthene	0.44 U	1.5
Chrysene	0.44 U	2.1
Dibenzo(a,h)anthracene	0.44 U	0.29 J
Fluoranthene	0.44 U	4.0
Fluorene	0.44 UJ	0.60 J
Indeno(1,2,3-cd)pyrene	0.44 U	1.3
Naphthalene	0.44 U	0.17 J
Phenanthrene	0.44 U	3.3
Pyrene	0.44 U	3.6

MW-12	
Depth(Feet)	(5 – 7)
Date	5/16/2005
All Analytes	No Detects

SB-6		
Depth(Feet)	(14.3 – 15.7)	(20 – 21)
Date	6/16/2004	6/16/2004
Naphthalene	0.74	0.87 [0.96]

MW-3		
Depth(Feet)	(14 – 16)	(24 – 26)
Date	6/25/2004	6/25/2004
All Analytes	No Detects	No Detects

MW-14		
Depth(Feet)	(14 – 16)	(20 – 22)
Date	9/9/2005	9/9/2005
Bis(2-ethylhexyl) phthalate	0.34 J [1.2]	0.61

SB-10		
Depth(Feet)	(8 – 9.5)	(28 – 32)
Date	6/24/2004	6/24/2004
Phenol	NA	0.46

SB-9		
Depth(Feet)	(4 – 6.5)	(10.8 – 13.1)
Date	6/10/2004	6/10/2004
Benzo(a)anthracene	0.11 J	0.58 U
Benzo(a)pyrene	0.12 J	0.58 U
Benzo(b)fluoranthene	0.099 J	0.58 U
Benzo(k)fluoranthene	0.10 J	0.58 U
Chrysene	0.11 J	0.16 J
Fluoranthene	0.19 J	0.26 J
Phenanthrene	0.11 J	0.21 J
Pyrene	0.19 J	0.26 J

TP-2		
Depth(Feet)	(2 – 2.5)	(3 – 3.5)
Date	6/24/2004	6/25/2004
Bis(2-ethylhexyl) phthalate	1.4	NA
Fluoranthene	0.11 J	0.39 U
Pyrene	0.099 J	0.39 U

MW-11	
Depth(Feet)	(14 – 16)
Date	5/12/2005
2-Methylnaphthalene	0.13 J
Acenaphthene	0.13 J
Anthracene	0.46
Benzo(a)anthracene	0.41 J
Benzo(a)pyrene	0.32 J
Benzo(b)fluoranthene	0.22 J
Benzo(g,h,i)perylene	0.14 J
Benzo(k)fluoranthene	0.25 J
Bis(2-ethylhexyl) phthalate	0.17 J
Carbazole	0.27 J
Chrysene	0.38 J
Dibenzofuran	0.12 J
Fluoranthene	0.70
Fluorene	0.27 J
Indeno(1,2,3-cd)pyrene	0.15 J
Phenanthrene	1.6
Pyrene	0.63

MW-6		
Depth(Feet)	(8 – 9.4)	(14.6 – 15.3)
Date	6/23/2004	6/23/2004
Acenaphthene	29	0.096 J
Acenaphthylene	12	0.40 U
Anthracene	39 D	0.33 J
Benzo(a)anthracene	50 D	1.2
Benzo(a)pyrene	43 D	0.66
Benzo(b)fluoranthene	34 D	0.70
Benzo(g,h,i)perylene	43 J	0.27 J
Benzo(k)fluoranthene	52	0.71
Chrysene	50 D	1.2
Dibenzo(a,h)anthracene	16 J	0.19 J
Fluoranthene	120 D	1.5
Fluorene	68 J	0.19 J
Indeno(1,2,3-cd)pyrene	57 J	0.36 J
Naphthalene	55	0.093 J
Phenanthrene	130 D	1.2
Pyrene	98 D	0.75

MW-7		
Depth(Feet)	(14 – 16)	(24 – 26)
Date	6/14/2004	6/14/2004
All Analytes	No Detects	No Detects

MW-2		
Depth(Feet)	(4.7 – 537)	(32 – 34)
Date	6/18/2004	6/18/2004
Acetophenone	0.12 J	NA
Bis(2-ethylhexyl) phthalate	0.15 J	NA

MW-10		
Depth(Feet)	(10 – 12)	(12 – 14)
Date	5/11/2005	5/11/2005
1,1'-Biphenyl	0.41 U	0.20 J
2-Methylnaphthalene	0.41 U	1.1
Acenaphthene	0.41 U	0.19 J
Acenaphthylene	0.41 U	1.1
Anthracene	0.086 J	1.1
Benzo(a)anthracene	0.41 U	0.76
Benzo(a)pyrene	0.41 U	0.64
Benzo(b)fluoranthene	0.41 UJ	0.41 J
Benzo(g,h,i)perylene	0.41 UJ	0.40 J
Benzo(k)fluoranthene	0.41 U	0.63
Bis(2-ethylhexyl) phthalate	0.41 U	0.11 J
Carbazole	0.41 U	0.53
Chrysene	0.41 U	0.72
Dibenzo(a,h)anthracene	0.41 U	0.13 J
Dibenzofuran	0.41 U	0.75
Fluoranthene	0.20 J	2.4
Fluorene	0.41 U	1.0
Indeno(1,2,3-cd)pyrene	0.41 U	0.39 J
Naphthalene	0.13 J	2.9
Phenanthrene	0.29 J	3.7
Pyrene	0.15 J	1.7

SB-1		
Depth(Feet)	(8 – 11)	(15.5 – 15.4)
Date	6/11/2004	6/11/2004
Acenaphthene	0.16 J	0.41 U
Anthracene	0.12 J	0.23 J
Benzo(a)anthracene	0.41 J	0.69
Benzo(a)pyrene	0.30 J	1.0
Benzo(b)fluoranthene	0.26 J	0.68
Benzo(g,h,i)perylene	0.12 J	0.51 J
Benzo(k)fluoranthene	0.26 J	0.76
Carbazole	NA	0.092 J
Chrysene	0.47	0.72
Dibenzo(a,h)anthracene	0.43 U	0.14 J
Fluoranthene	1.1	1.2
Fluorene	0.16 J	0.41 UJ
Indeno(1,2,3-cd)pyrene	0.14 J	0.60 J
Naphthalene	0.15 J	0.31 J
Phenanthrene	1.0	0.89
Pyrene	0.96	1.3

SB-11		
Depth(Feet)	(6 – 10)	(16 – 20)
Date	5/11/2005	5/11/2005
1,1'-Biphenyl	0.11 J	0.39 U [0.40 U]
2-Methylnaphthalene	0.52	0.39 U [0.40 U]
Acenaphthene	0.10 J	0.39 U [0.40 U]
Acenaphthylene	0.64	0.39 U [0.40 U]
Anthracene	0.76	0.39 U [0.40 U]
Benzo(a)anthracene	0.66	0.097 J [0.40 U]
Benzo(a)pyrene	0.58	0.11 J [0.40 U]
Benzo(b)fluoranthene	0.42 J	0.088 J [0.40 UJ]
Benzo(g,h,i)perylene	0.39 J	0.11 J [0.40 UJ]
Benzo(k)fluoranthene	0.58	0.099 J [0.40 U]
Bis(2-ethylhexyl) phthalate	0.29 J	0.13 J [0.40 U]
Carbazole	0.35 J	0.39 U [0.40 U]
Chrysene	0.64	0.12 J [0.40 U]
Dibenzo(a,h)anthracene	0.12 J	0.39 U [0.40 U]
Dibenzofuran	0.45	0.39 U [0.40 U]
Di-n-octyl phthalate	0.36 U	0.39 U [0.081 J]
Fluoranthene	1.8	0.31 J [0.12 J]
Fluorene	0.63	0.39 U [0.40 U]
Indeno(1,2,3-cd)pyrene	0.35 J	0.39 U [0.40 U]
Naphthalene	1.2	0.36 J [0.30 J]
Phenanthrene	2.5	0.36 J [0.15 J]
Pyrene	1.3	0.31 J [0.13 J]

MW-4		
Depth(Feet)	(8 – 10)	(28 – 30)
Date	6/22/2004	6/22/2004
Fluoranthene	0.10 J	0.35 U
Pyrene	0.10 J	0.35 U

SB-4		
Depth(Feet)	(14 – 16)	(26 – 27.5)
Date	6/8/2004	6/8/2004
All Analytes	No Detects	No Detects

SB-5		
Depth(Feet)	(14 – 15.8)	(16 – 17.3)
Date	6/22/2004	6/22/2004
Acenaphthylene	0.14 J	0.41 U
Benzo(a)anthracene	0.56	0.41 U
Benzo(a)pyrene	0.35 J	0.41 U
Benzo(b)fluoranthene	0.19 J	0.41 U
Benzo(k)fluoranthene	0.32 J	0.41 U
Chrysene	0.54	0.41 U
Fluoranthene	0.58	0.41 U
Indeno(1,2,3-cd)pyrene	0.085 J	0.41 U
Pyrene	0.57	0.41 U

SB-3		
Depth(Feet)	(10 – 12)	(22 – 24)
Date	6/17/2004	6/17/2004
All Analytes	No Detects	No Detects

MW-8		
Depth(Feet)	(11.3 – 13.1)	(18 – 20)
Date	6/23/2004	6/22/2004
Naphthalene	0.21 J	0.39 U
Phenol	0.47	NA

SB-12		
Depth(Feet)	(2 – 4)	(12 – 14)
Date	5/17/2005	5/17/2005
Anthracene	0.38 U	0.10 J
Benzo(a)anthracene	0.38 U	0.70
Benzo(a)pyrene	0.38 U	0.53
Benzo(b)fluoranthene	0.38 UJ	0.37 J
Benzo(g,h,i)perylene	0.38 U	0.25 J
Benzo(k)fluoranthene	0.38 U	0.52
Bis(2-ethylhexyl) phthalate	0.38 U	0.12 J
Chrysene	0.38 U	0.60
Dibenzo(a,h)anthracene	0.38 U	0.14 J
Fluoranthene	0.38 U	0.77
Indeno(1,2,3-cd)pyrene	0.38 U	0.27 J
Phenanthrene	0.38 U	0.14 J
Pyrene	0.38 U	0.82

SB-13		
Depth(Feet)	(2 – 4)	(16 – 18)
Date	5/17/2005	5/17/2005
Benzo(a)anthracene	0.41 U	0.12 J
Benzo(a)pyrene	0.41 U	0.16 J
Benzo(b)fluoranthene	0.41 UJ	0.12 J
Benzo(g,h,i)perylene	0.41 U	0.14 J
Benzo(k)fluoranthene	0.41 U	0.13 J
Bis(2-ethylhexyl) phthalate	0.26 J	0.096 J
Chrysene	0.41 U	0.12 J
Fluoranthene	0.41 U	0.18 J
Indeno(1,2,3-cd)pyrene	0.41 U	0.12 J
Phenanthrene	0.41 U	0.14 J
Pyrene	0.41 U	0.18 J

MW-9	
Depth(Feet)	(10 – 12)
Date	5/12/2005
1,1'-Biphenyl	0.13 J
2-Methylnaphthalene	0.16 J
Anthracene	0.29 J
Benzo(a)anthracene	0.32 J
Benzo(a)pyrene	0.21 J
Benzo(b)fluoranthene	0.15 J
Benzo(g,h,i)perylene	0.099 J
Benzo(k)fluoranthene	0.18 J
Chrysene	0.30 J
Dibenzofuran	0.54
Fluoranthene	0.75
Fluorene	0.16 J
Indeno(1,2,3-cd)pyrene	0.090 J
Naphthalene	0.51
Phenanthrene	2.1
Pyrene	0.57

SB-7		
Depth(Feet)	(14 – 16)	(35.2 – 32.7)
Date	6/10/2004	6/11/2004
Benzo(a)anthracene	0.14 J	0.41 U
Benzo(a)pyrene	0.18 J	0.41 U
Benzo(b)fluoranthene	0.12 J	0.41 U
Benzo(g,h,i)perylene	0.12 J	0.41 UJ
Benzo(k)fluoranthene	0.16 J	0.41 U
Chrysene	0.15 J	0.41 U
Fluoranthene	0.23 J	0.41 U
Indeno(1,2,3-cd)pyrene	0.11 J	0.41 UJ
Phenanthrene	0.13 J	0.41 U
Pyrene	0.24 J	0.41 U

LEGEND:

MW-8A ⊕ MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009

MW-7 MONITORING WELL LOCATION

SS-8 △ SURFACE SOIL SAMPLE LOCATION

SB-10 ▲ SOIL BORING LOCATION

TP-4 TEST PIT LOCATION

SG-101△ PERMANENT SOIL-GAS SAMPLING LOCATION

SG-108T△ TEMPORARY SOIL-GAS SAMPLING LOCATION

AA-1 AMBIENT AIR SAMPLE LOCATION

BUILDING/STRUCTURE

—x——x— FENCE

— — — — APPROXIMATE PROPERTY LINE

APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 2004.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
4. LOCATIONS OF SOIL BORINGS SB-11, SB-12, AND SB-13 ARE APPROXIMATE.
5. LOCATIONS SOIL GAS WELLS SG-1, SG-2, SG-3, SG-5, AND SG-6 ARE APPROXIMATE.
6. U = CONSTITUENT NOT DETECTED AT A CONCENTRATION ABOVE THE REPORTED DETECTION LIMIT.
   UJ = THE COMPOUND WAS NOT DETECTED ABOVE THE REPORTED SAMPLE QUANTITATION LIMIT. HOWEVER, THE REPORTED LIMIT IS APPROXIMATE AND MAY OR MAY NOT REPRESENT THE ACTUAL LIMIT OF QUANTITATION.
   D = CONCENTRATION IS BASED ON A DILUTED SAMPLE ANALYSIS.
   J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

0 100' 200'

GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

DETECTED SVOC CONCENTRATIONS IN SOIL (ppm)

ARCADIS

FIGURE
8

CITY: SYRACUSE, NY GROUP: ENVCAD DB: N. SMITHGALL, R. BASSETT PM/TM/TR: A. KORIK LYR: ON=*;OFF=REF (FRZ) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/24/2012 8:02 PM BY: BASSETT, RICHARD
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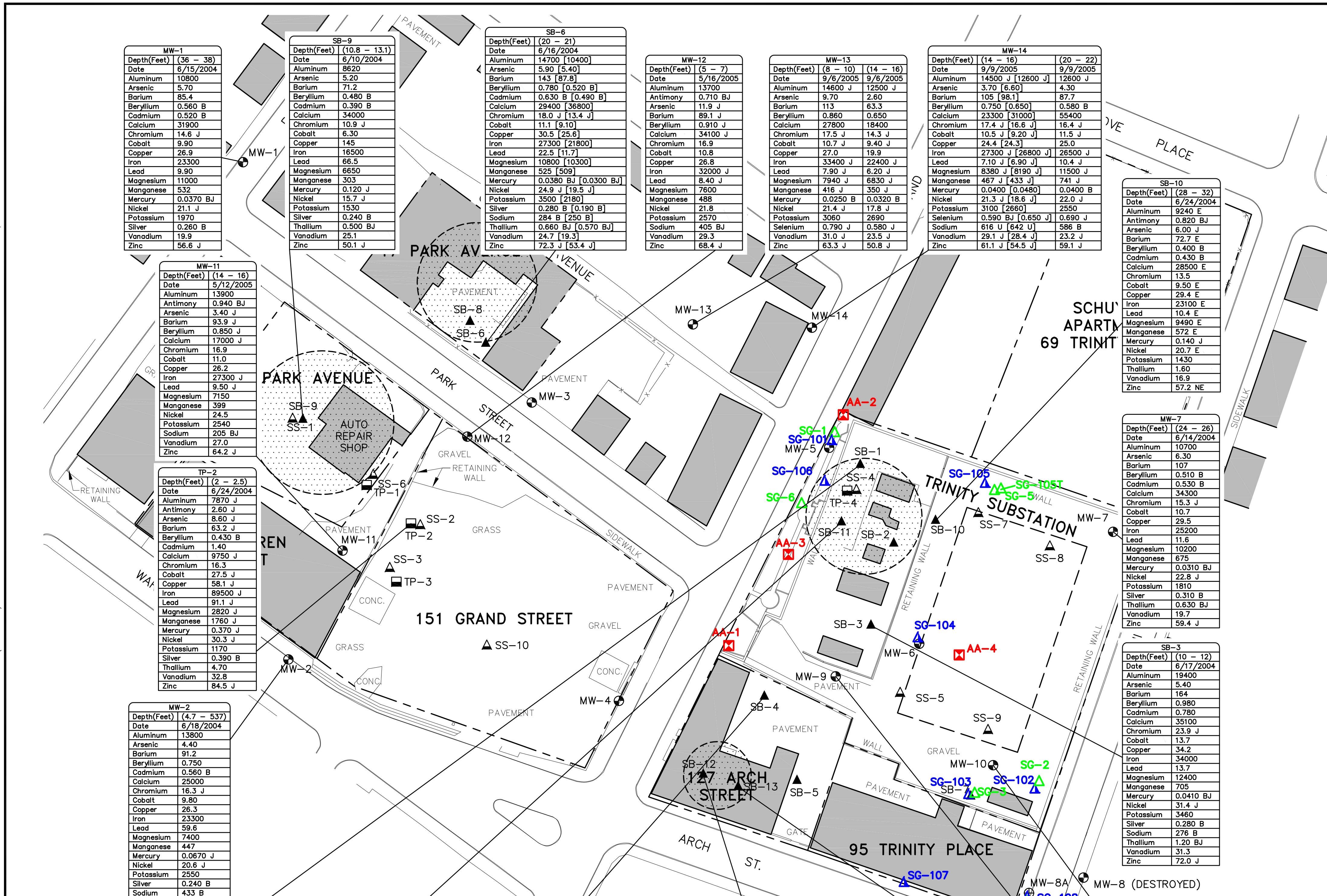
XREFS: 36639X03 IMAGES: PROJECTNAME: ----



MW-1

Depth(Feet)	(36 – 38)
Date	6/15/2004
Aluminum	10800
Arsenic	5.70
Barium	85.4
Beryllium	0.560 B
Cadmium	0.520 B
Calcium	31900
Chromium	14.6 J
Cobalt	9.90
Copper	26.9
Iron	23300
Lead	9.90
Magnesium	11000
Manganese	532
Mercury	0.0370 BJ
Nickel	21.1 J
Potassium	1970
Silver	0.260 B
Vanadium	19.9
Zinc	56.6 J

SB-9

Depth(Feet)	(10.8 – 13.1)
Date	6/10/2004
Aluminum	8620
Arsenic	5.20
Barium	71.2
Beryllium	0.480 B
Cadmium	0.390 B
Calcium	34000
Chromium	10.9 J
Cobalt	6.30
Copper	145
Iron	16500
Lead	66.5
Magnesium	6650
Manganese	303
Mercury	0.120 J
Nickel	15.7 J
Potassium	1530
Silver	0.240 B
Thallium	0.500 BJ
Vanadium	25.1
Zinc	50.1 J

SB-6

Depth(Feet)	(20 – 21)
Date	6/16/2004
Aluminum	14700 [10400]
Arsenic	5.90 [5.40]
Barium	143 [87.8]
Beryllium	0.780 [0.520 B]
Cadmium	0.630 B [0.490 B]
Calcium	29400 [36800]
Chromium	18.0 J [13.4 J]
Cobalt	11.1 [9.10]
Copper	30.5 [25.6]
Iron	27300 [21800]
Lead	22.5 [11.7]
Magnesium	10800 [10300]
Manganese	525 [509]
Mercury	0.0380 BJ [0.0300 BJ]
Nickel	24.9 J [19.5 J]
Potassium	3500 [2180]
Silver	0.280 B [0.190 B]
Sodium	284 B [250 B]
Thallium	0.660 BJ [0.570 BJ]
Vanadium	24.7 [19.3]
Zinc	72.3 J [53.4 J]

MW-12

Depth(Feet)	(5 – 7)
Date	5/16/2005
Aluminum	13700
Antimony	0.710 BJ
Arsenic	11.9 J
Barium	89.1 J
Beryllium	0.910 J
Calcium	34100 J
Chromium	16.9
Cobalt	10.8
Copper	26.8
Iron	32000 J
Lead	8.40 J
Magnesium	7600
Manganese	488
Nickel	21.8
Potassium	2570
Sodium	405 BJ
Vanadium	29.3
Zinc	68.4 J

MW-13

Depth(Feet)	(8 – 10)	(14 – 16)
Date	9/6/2005	9/6/2005
Aluminum	14600 J	12500 J
Arsenic	9.70	2.60
Barium	113	63.3
Beryllium	0.860	0.650
Calcium	27800	18400
Chromium	17.5 J	14.3 J
Cobalt	10.7	9.40 J
Copper	27.0	19.9
Iron	33400 J	22400 J
Lead	7.90 J	8.20 J
Magnesium	7940 J	6830 J
Manganese	416 J	350 J
Mercury	0.0250 B	0.0320 B
Nickel	21.4 J	17.8 J
Potassium	3060	2690
Selenium	0.790 J	0.580 J
Vanadium	31.0 J	23.5 J
Zinc	63.3 J	50.8 J

MW-14

Depth(Feet)	(14 – 16)	(20 – 22)
Date	9/9/2005	9/9/2005
Aluminum	14500 J [12600 J]	12600 J
Arsenic	3.70 [6.60]	4.30
Barium	105 [98.1]	87.7
Beryllium	0.750 [0.650]	0.580 B
Calcium	23300 [31000]	55400
Chromium	17.4 J [16.6 J]	16.4 J
Cobalt	10.5 J [9.20 J]	11.5 J
Copper	24.4 [24.3]	25.0
Iron	27300 J [26800 J]	26500 J
Lead	7.10 J [6.90 J]	10.4 J
Magnesium	8380 J [8190 J]	11500 J
Manganese	467 J [433 J]	741 J
Mercury	0.0400 [0.0480]	0.0400 B
Nickel	21.3 J [18.6 J]	22.0 J
Potassium	3100 [2660]	2550
Selenium	0.590 BJ [0.650 J]	0.690 J
Sodium	616 U [642 U]	586 B
Vanadium	29.1 J [28.4 J]	23.2 J
Zinc	61.1 J [54.5 J]	59.1 J

SB-10

Depth(Feet)	(28 – 32)
Date	6/24/2004
Aluminum	9240 E
Antimony	0.820 BJ
Arsenic	6.00 J
Barium	72.7 E
Beryllium	0.400 B
Cadmium	0.430 B
Calcium	28500 E
Chromium	13.5
Cobalt	9.50 E
Copper	29.4 E
Iron	23100 E
Lead	10.4 E
Magnesium	9490 E
Manganese	572 E
Mercury	0.140 J
Nickel	20.7 E
Potassium	1430
Thallium	1.60
Vanadium	16.9
Zinc	57.2 NE

MW-11

Depth(Feet)	(14 – 16)
Date	5/12/2005
Aluminum	13900
Antimony	0.940 BJ
Arsenic	3.40 J
Barium	93.9 J
Beryllium	0.850 J
Calcium	17000 J
Chromium	16.9
Cobalt	11.0
Copper	26.2
Iron	27300 J
Lead	9.50 J
Magnesium	7150
Manganese	399
Nickel	24.5
Potassium	2540
Sodium	205 BJ
Vanadium	27.0
Zinc	64.2 J

TP-2

Depth(Feet)	(2 – 2.5)
Date	6/24/2004
Aluminum	7870 J
Antimony	2.60 J
Arsenic	8.60 J
Barium	63.2 J
Beryllium	0.430 B
Cadmium	1.40
Calcium	9750 J
Chromium	16.3
Cobalt	27.5 J
Copper	58.1 J
Iron	89500 J
Lead	91.1 J
Magnesium	2820 J
Manganese	1760 J
Mercury	0.370 J
Nickel	30.3 J
Potassium	1170
Silver	0.390 B
Thallium	4.70
Vanadium	32.8
Zinc	84.5 J

MW-2

Depth(Feet)	(4.7 – 537)
Date	6/18/2004
Aluminum	13800
Arsenic	4.40
Barium	91.2
Beryllium	0.750
Cadmium	0.560 B
Calcium	25000
Chromium	16.3 J
Cobalt	9.80
Copper	26.3
Iron	23300
Lead	59.6
Magnesium	7400
Manganese	447
Mercury	0.0670 J
Nickel	20.6 J
Potassium	2550
Silver	0.240 B
Sodium	433 B
Thallium	0.880 BJ
Vanadium	27.3
Zinc	60.5 J

MW-7

Depth(Feet)	(24 – 26)
Date	6/14/2004
Aluminum	10700
Arsenic	6.30
Barium	107
Beryllium	0.510 B
Cadmium	0.530 B
Calcium	34300
Chromium	15.3 J
Cobalt	10.7
Copper	29.5
Iron	25200
Lead	11.6
Magnesium	10200
Manganese	675
Mercury	0.0310 BJ
Nickel	22.8 J
Potassium	1810
Silver	0.310 B
Thallium	0.630 BJ
Vanadium	19.7
Zinc	59.4 J

SB-3

Depth(Feet)	(10 – 12)
Date	6/17/2004
Aluminum	19400
Arsenic	5.40
Barium	164
Beryllium	0.980
Cadmium	0.780
Calcium	35100
Chromium	23.9 J
Cobalt	13.7
Copper	34.2
Iron	34000
Lead	13.7
Magnesium	12400
Manganese	705
Mercury	0.0410 BJ
Nickel	31.4 J
Potassium	3460
Silver	0.280 B
Sodium	276 B
Thallium	1.20 BJ
Vanadium	31.3
Zinc	72.0 J

SB-1

Depth(Feet)	(15.5 – 15.4)
Date	6/11/2004
Aluminum	11900
Arsenic	7.00
Barium	90.2
Beryllium	0.700
Cadmium	0.670
Calcium	30000
Chromium	16.5 J
Cobalt	12.1
Copper	71.7
Iron	27600
Lead	94.5
Magnesium	7040
Manganese	424
Mercury	0.100 J
Nickel	24.5 J
Potassium	2140
Silver	0.250 B
Sodium	268 B
Thallium	0.830 BJ
Vanadium	26.8
Zinc	94.7 J

SB-11

Depth(Feet)	(6 – 10)	(16 – 20)
Date	5/11/2005	5/11/2005
Aluminum	9480	7500 [8610]
Antimony	0.620 BJ	0.730 BJ [0.780 BJ]
Arsenic	7.80 J	5.10 J [5.20 J]
Barium	74.8 J	59.2 J [68.0 J]
Beryllium	0.510 J	0.460 J [0.510 J]
Cadmium	0.260 B	0.0200 U [0.0200 U]
Calcium	23600 J	44800 J [77900 J]
Chromium	13.9	12.5 [13.5]
Cobalt	11.1	8.40 [8.80]
Copper	24.5	39.9 [34.9]
Iron	23500 J	22000 J [22000 J]
Lead	21.2 J	34.0 J [65.3 J]
Magnesium	6510	15400 [34500]
Manganese	1240	426 [424]
Nickel	20.1	18.4 [19.4]
Potassium	1070	1450 [1770]
Sodium	162 BJ	216 BJ [221 BJ]
Vanadium	14.0	17.9 [19.5]
Zinc	640 J	53.6 J [51.6 J]

SB-4

Depth(Feet)	(14 – 16)
Date	6/8/2004
Aluminum	15800
Arsenic	5.80
Barium	135
Beryllium	0.830
Cadmium	0.580 B
Calcium	24300
Chromium	20.6 E
Cobalt	12.1
Copper	30.5
Iron	30400
Lead	11.6
Magnesium	9800
Manganese	546
Mercury	0.0360 BJ
Nickel	28.4 E
Potassium	2790
Silver	0.260 B
Sodium	269 B
Thallium	1.30 BJ
Vanadium	26.4
Zinc	74.5 E

SB-12

Depth(Feet)	(2 – 4)	(12 – 14)
Date	5/17/2005	5/17/2005
Aluminum	7990	8860
Antimony	0.460 BJ	1.10 BJ
Arsenic	3.80 J	5.30 J
Barium	44.1 J	52.9 J
Beryllium	0.480 BJ	0.530 BJ
Calcium	15900 J	20800 J
Chromium	11.9	12.8
Cobalt	8.30	8.10
Copper	23.8	29.2
Iron	17400 J	20400 J
Lead	36.8 J	46.8 J
Magnesium	5440	6420
Manganese	297	550
Mercury	0.530	0.230
Nickel	16.7	18.2
Potassium	1500	1740
Sodium	185 BJ	189 BJ
Vanadium	17.0	18.3
Zinc	55.1 J	56.6 J

SB-13

Depth(Feet)	(2 – 4)	(16 – 18)
Date	5/17/2005	5/17/2005
Aluminum	10400	10700
Antimony	0.600 BJ	0.660 BJ
Arsenic	4.50 J	5.80 J
Barium	67.0 J	71.7 J
Beryllium	0.620 J	0.630 J
Calcium	16200 J	18200 J
Chromium	13.0	14.0
Cobalt	8.50	8.70
Copper	22.4	25.6
Iron	21500 J	23600 J
Lead	27.3 J	36.8 J
Magnesium	5100	6260
Manganese	455	451
Mercury	0.120	0.150
Nickel	18.8	20.0
Potassium	1890	2030
Sodium	199 BJ	173 BJ
Vanadium	20.0	20.2
Zinc	54.7 J	59.3 J

MW-9

Depth(Feet)	(10 – 12)
Date	5/12/2005
Aluminum	17400
Antimony	1.00 BJ
Arsenic	4.50 J
Barium	143 J
Beryllium	1.00 J
Calcium	19400 J
Chromium	21.4
Cobalt	13.2
Copper	30.4
Iron	33600 J
Lead	13.6 J
Magnesium	10500
Manganese	488
Nickel	31.8
Potassium	3080
Sodium	169 BJ
Vanadium	26.7
Zinc	80.2 J

MW-10

Depth(Feet)	(10 – 12)	(12 – 14)
Date	5/11/2005	5/11/2005
Aluminum	9020	11500
Antimony	0.790 BJ	0.820 BJ
Arsenic	6.10 J	7.20 J
Barium	107 J	103 J
Beryllium	0.550 J	0.650 J
Calcium	NA	34000 J
Chromium	15.4	24.4
Cobalt	10.7	12.1
Copper	32.6	36.5
Iron	NA	28500 J
Lead	NA	14.7 J
Magnesium	10900	10200
Manganese	476	599
Nickel	24.0	27.8
Potassium	1560	2160
Sodium	149 BJ	167 BJ
Vanadium	22.7	22.8
Zinc	NA	83.1 J

LEGEND:

- MW-8A ⊕ MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
- MW-7 MONITORING WELL LOCATION
- SS-8 △ SURFACE SOIL SAMPLE LOCATION
- SB-10 ▲ SOIL BORING LOCATION
- TP-4 TEST PIT LOCATION
- SG-101△ PERMANENT SOIL-GAS SAMPLING LOCATION
- SG-108T△ TEMPORARY SOIL-GAS SAMPLING LOCATION
- AA-1 AMBIENT AIR SAMPLE LOCATION
- BUILDING/STRUCTURE
- —x—x— FENCE
- — — — APPROXIMATE PROPERTY LINE
- APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

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6. B = THE REPORTED VALUE WAS OBTAINED FROM A READING LESS THAN THE CONTRACT REQUIRED DETECTION LIMIT BUT GREATER THAN OR EQUAL TO THE INSTRUMENT DETECTION LIMIT.

   E = THE REPORTED VALUE IS ESTIMATED DUE TO THE PRESENCE OF INTERFERENCE.

   J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

0 100' 200'

GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

INORGANIC CONCENTRATIONS IN SOIL (ppm)

ARCADIS

FIGURE
9

CITY: SYRACUSE, NY GROUP: ENVCAD DB: N. SMITHGALL, R. BASSETT PM/TM/TR: A. KORIK LYR: ON=*;OFF=REF, (FRZ)
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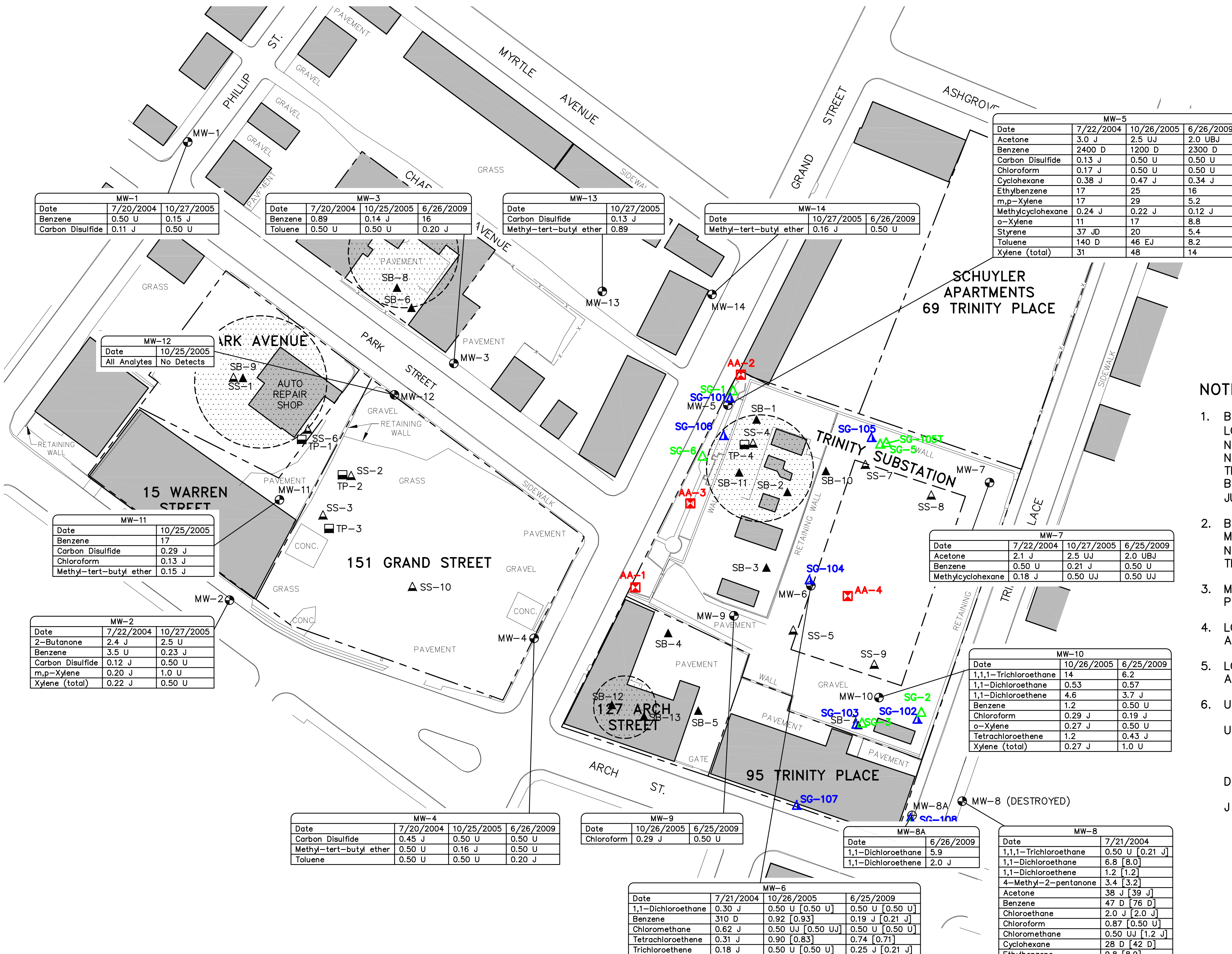

MW-1		
Date	7/20/2004	10/27/2005
Benzene	0.50 U	0.15 J
Carbon Disulfide	0.11 J	0.50 U

MW-3			
Date	7/20/2004	10/25/2005	6/26/2009
Benzene	0.89	0.14 J	16
Toluene	0.50 U	0.50 U	0.20 J

MW-13	
Date	10/27/2005
Carbon Disulfide	0.13 J
Methyl-tert-butyl ether	0.89

MW-14		
Date	10/27/2005	6/26/2009
Methyl-tert-butyl ether	0.16 J	0.50 U

MW-5			
Date	7/22/2004	10/26/2005	6/26/2009
Acetone	3.0 J	2.5 UJ	2.0 UBJ
Benzene	2400 D	1200 D	2300 D
Carbon Disulfide	0.13 J	0.50 U	0.50 U
Chloroform	0.17 J	0.50 U	0.50 U
Cyclohexane	0.38 J	0.47 J	0.34 J
Ethylbenzene	17	25	16
m,p-Xylene	17	29	5.2
Methylcyclohexane	0.24 J	0.22 J	0.12 J
o-Xylene	11	17	8.8
Styrene	37 JD	20	5.4
Toluene	140 D	46 EJ	8.2
Xylene (total)	31	48	14

MW-12	
Date	10/25/2005
All Analytes	No Detects

MW-11	
Date	10/25/2005
Benzene	17
Carbon Disulfide	0.29 J
Chloroform	0.13 J
Methyl-tert-butyl ether	0.15 J

MW-2		
Date	7/22/2004	10/27/2005
2-Butanone	2.4 J	2.5 U
Benzene	3.5 U	0.23 J
Carbon Disulfide	0.12 J	0.50 U
m,p-Xylene	0.20 J	1.0 U
Xylene (total)	0.22 J	0.50 U

MW-7			
Date	7/22/2004	10/27/2005	6/25/2009
Acetone	2.1 J	2.5 UJ	2.0 UBJ
Benzene	0.50 U	0.21 J	0.50 U
Methylcyclohexane	0.18 J	0.50 UJ	0.50 UJ

MW-10		
Date	10/26/2005	6/25/2009
1,1,1-Trichloroethane	14	6.2
1,1-Dichloroethane	0.53	0.57
1,1-Dichloroethene	4.6	3.7 J
Benzene	1.2	0.50 U
Chloroform	0.29 J	0.19 J
o-Xylene	0.27 J	0.50 U
Tetrachloroethene	1.2	0.43 J
Xylene (total)	0.27 J	1.0 U

MW-4			
Date	7/20/2004	10/25/2005	6/26/2009
Carbon Disulfide	0.45 J	0.50 U	0.50 U
Methyl-tert-butyl ether	0.50 U	0.16 J	0.50 U
Toluene	0.50 U	0.50 U	0.20 J

MW-9		
Date	10/26/2005	6/25/2009
Chloroform	0.29 J	0.50 U

MW-8A	
Date	6/26/2009
1,1-Dichloroethane	5.9
1,1-Dichloroethene	2.0 J

MW-6			
Date	7/21/2004	10/26/2005	6/25/2009
1,1-Dichloroethane	0.30 J	0.50 U [0.50 U]	0.50 U [0.50 U]
Benzene	310 D	0.92 [0.93]	0.19 J [0.21 J]
Chloromethane	0.62 J	0.50 UJ [0.50 UJ]	0.50 U [0.50 U]
Tetrachloroethene	0.31 J	0.90 [0.83]	0.74 [0.71]
Trichloroethene	0.18 J	0.50 U [0.50 U]	0.25 J [0.21 J]

MW-8	
Date	7/21/2004
1,1,1-Trichloroethane	0.50 U [0.21 J]
1,1-Dichloroethane	6.8 [8.0]
1,1-Dichloroethene	1.2 [1.2]
4-Methyl-2-pentanone	3.4 [3.2]
Acetone	38 J [39 J]
Benzene	47 D [76 D]
Chloroethane	2.0 J [2.0 J]
Chloroform	0.87 [0.50 U]
Chloromethane	0.50 UJ [1.2 J]
Cyclohexane	28 D [42 D]
Ethylbenzene	9.8 [8.9]
Isopropylbenzene	1.9 [1.8]
m,p-Xylene	35 [32]
Methylcyclohexane	22 D [33 D]
o-Xylene	11 [10]
Toluene	6.3 [5.9]
Xylene (total)	51 [47]

LEGEND:

- MW-8A — MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
- MW-7 — MONITORING WELL LOCATION
- SS-8 — SURFACE SOIL SAMPLE LOCATION
- SB-10 — SOIL BORING LOCATION
- TP-4 — TEST PIT LOCATION
- SG-101 — PERMANENT SOIL-GAS SAMPLING LOCATION
- SG-108T — TEMPORARY SOIL-GAS SAMPLING LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- BUILDING/STRUCTURE
- —x——x— FENCE
- — — — — APPROXIMATE PROPERTY LINE
- APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 2004.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
4. LOCATIONS OF SOIL BORINGS SB-11, SB-12, AND SB-13 ARE APPROXIMATE.
5. LOCATIONS SOIL GAS WELLS SG-1, SG-2, SG-3, SG-5, AND SG-6 ARE APPROXIMATE.
6. U = CONSTITUENT NOT DETECTED AT A CONCENTRATION ABOVE THE REPORTED DETECTION LIMIT.
   UJ = THE COMPOUND WAS NOT DETECTED ABOVE THE REPORTED SAMPLE QUANTITATION LIMIT. HOWEVER, THE REPORTED LIMIT IS APPROXIMATE AND MAY OR MAY NOT REPRESENT THE ACTUAL LIMIT OF QUANTITATION.
   D = CONCENTRATION IS BASED ON A DILUTED SAMPLE ANALYSIS.
   J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

0 100' 200'

GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

DETECTED VOC CONCENTRATIONS IN GROUNDWATER (ppb)

ARCADIS

FIGURE 10

CITY: SYRACUSE, NY GROUP: ENVCAD DB: N. SMITHGALL, R. BASSETT PM/TM/TR: A. KORIK LYR: ON=*;OFF=REF (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0036639\0001\00015\DWG\SMP\36639C08.DWG LAYOUT: 10 SAVED: 2/24/2012 9:35 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/24/2012 9:36 PM BY: BASSETT, RICHARD
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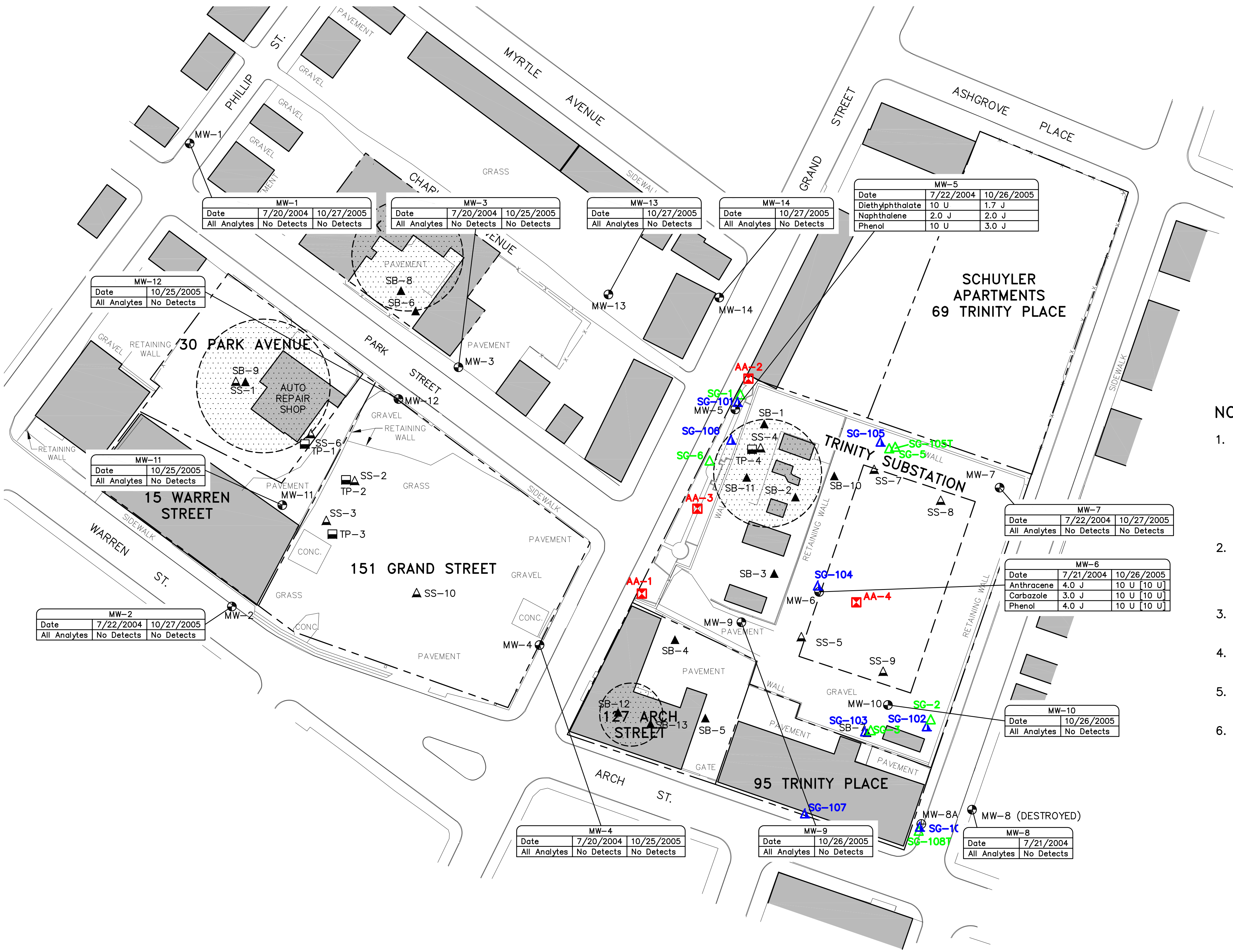

LEGEND:

- MW-8A — MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
- MW-7 — MONITORING WELL LOCATION
- SS-8 — SURFACE SOIL SAMPLE LOCATION
- SB-10 — SOIL BORING LOCATION
- TP-4 — TEST PIT LOCATION
- SG-101 — PERMANENT SOIL-GAS SAMPLING LOCATION
- SG-108T — TEMPORARY SOIL-GAS SAMPLING LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- BUILDING/STRUCTURE
- FENCE
- APPROXIMATE PROPERTY LINE
- APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

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3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
4. LOCATIONS OF SOIL BORINGS SB-11, SB-12, AND SB-13 ARE APPROXIMATE.
5. LOCATIONS SOIL GAS WELLS SG-1, SG-2, SG-3, SG-5, AND SG-6 ARE APPROXIMATE.
6. U = CONSTITUENT NOT DETECTED AT A CONCENTRATION ABOVE THE REPORTED DETECTION LIMIT.

   J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

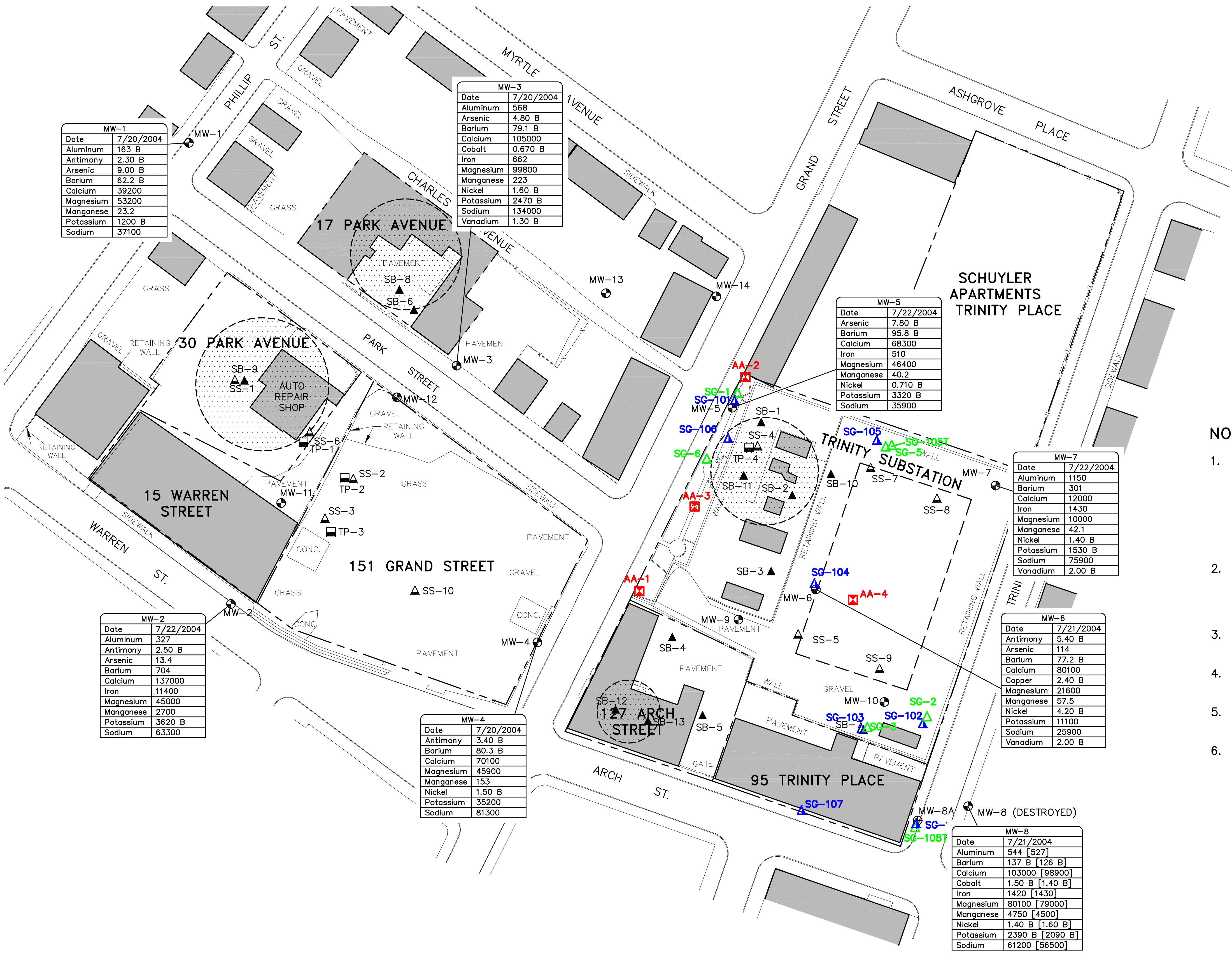
0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

DETECTED SVOC CONCENTRATIONS IN GROUNDWATER (ppb)

ARCADIS

FIGURE
11



MW-1	
Date	7/20/2004
Aluminum	163 B
Antimony	2.30 B
Arsenic	9.00 B
Barium	62.2 B
Calcium	39200
Magnesium	53200
Manganese	23.2
Potassium	1200 B
Sodium	37100

MW-3	
Date	7/20/2004
Aluminum	568
Arsenic	4.80 B
Barium	79.1 B
Calcium	105000
Cobalt	0.670 B
Iron	662
Magnesium	99800
Manganese	223
Nickel	1.60 B
Potassium	2470 B
Sodium	134000
Vanadium	1.30 B

MW-5	
Date	7/22/2004
Arsenic	7.80 B
Barium	95.8 B
Calcium	68300
Iron	510
Magnesium	46400
Manganese	40.2
Nickel	0.710 B
Potassium	3320 B
Sodium	35900

MW-7	
Date	7/22/2004
Aluminum	1150
Barium	301
Calcium	12000
Iron	1430
Magnesium	10000
Manganese	42.1
Nickel	1.40 B
Potassium	1530 B
Sodium	75900
Vanadium	2.00 B

MW-6	
Date	7/21/2004
Antimony	5.40 B
Arsenic	114
Barium	77.2 B
Calcium	80100
Copper	2.40 B
Magnesium	21600
Manganese	57.5
Nickel	4.20 B
Potassium	11100
Sodium	25900
Vanadium	2.00 B

MW-2	
Date	7/22/2004
Aluminum	327
Antimony	2.50 B
Arsenic	13.4
Barium	704
Calcium	137000
Iron	11400
Magnesium	45000
Manganese	2700
Potassium	3620 B
Sodium	63300

MW-4	
Date	7/20/2004
Antimony	3.40 B
Barium	80.3 B
Calcium	70100
Magnesium	45900
Manganese	153
Nickel	1.50 B
Potassium	35200
Sodium	81300

MW-8	
Date	7/21/2004
Aluminum	544 [527]
Barium	137 B [126 B]
Calcium	103000 [98900]
Cobalt	1.50 B [1.40 B]
Iron	1420 [1430]
Magnesium	80100 [79000]
Manganese	4750 [4500]
Nickel	1.40 B [1.60 B]
Potassium	2390 B [2090 B]
Sodium	61200 [56500]

LEGEND:

- MW-8A — MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
- MW-7 — MONITORING WELL LOCATION
- SS-8 — SURFACE SOIL SAMPLE LOCATION
- SB-10 — SOIL BORING LOCATION
- TP-4 — TEST PIT LOCATION
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- BUILDING/STRUCTURE
- FENCE
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3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
4. LOCATIONS OF SOIL BORINGS SB-11, SB-12, AND SB-13 ARE APPROXIMATE.
5. LOCATIONS SOIL GAS WELLS SG-1, SG-2, SG-3, SG-5, AND SG-6 ARE APPROXIMATE.
6. B = THE COMPOUND HAS BEEN FOUND IN THE SAMPLE AS WELL AS THE ASSOCIATED BLANK, ITS PRESENCE IN THE SAMPLE MAY BE SUSPECT.

0 100' 200'

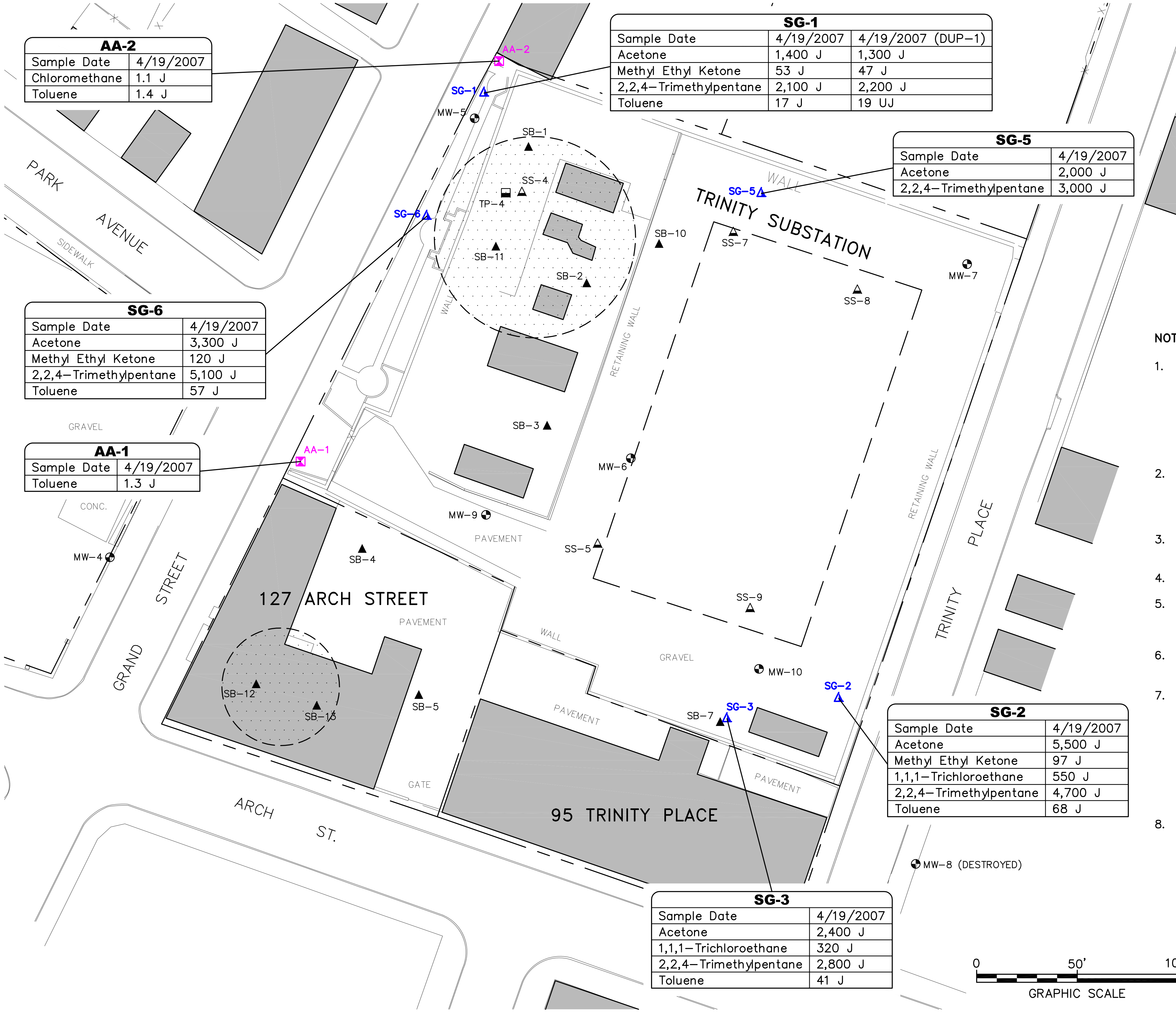
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

INORGANIC CONCENTRATIONS IN GROUNDWATER (ppb)

ARCADIS

FIGURE **12**



AA-2

Sample Date	4/19/2007
Chloromethane	1.1 J
Toluene	1.4 J

SG-1

Sample Date	4/19/2007	4/19/2007 (DUP-1)
Acetone	1,400 J	1,300 J
Methyl Ethyl Ketone	53 J	47 J
2,2,4-Trimethylpentane	2,100 J	2,200 J
Toluene	17 J	19 UJ

SG-5

Sample Date	4/19/2007
Acetone	2,000 J
2,2,4-Trimethylpentane	3,000 J

SG-6

Sample Date	4/19/2007
Acetone	3,300 J
Methyl Ethyl Ketone	120 J
2,2,4-Trimethylpentane	5,100 J
Toluene	57 J

AA-1

Sample Date	4/19/2007
Toluene	1.3 J

SG-2

Sample Date	4/19/2007
Acetone	5,500 J
Methyl Ethyl Ketone	97 J
1,1,1-Trichloroethane	550 J
2,2,4-Trimethylpentane	4,700 J
Toluene	68 J

SG-3

Sample Date	4/19/2007
Acetone	2,400 J
1,1,1-Trichloroethane	320 J
2,2,4-Trimethylpentane	2,800 J
Toluene	41 J

LEGEND:

- MW-7 MONITORING WELL LOCATION
- SS-8 SURFACE SOIL SAMPLE LOCATION
- SB-10 SOIL BORING LOCATION
- TP-4 TEST PIT LOCATION
- SG-1 SOIL-GAS SAMPLING LOCATION
- AA-1 AMBIENT AIR SAMPLE LOCATION
- BUILDING/STRUCTURE
- FENCE
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2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. LOCATIONS OF SOIL BORINGS SB-10, SB-11, SB-12, AND SB-13 ARE APPROXIMATE.
4. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
5. LOCATIONS OF SOIL-GAS AND AMBIENT AIR SAMPLING LOCATIONS ARE BASED ON FIELD MEASUREMENTS FROM EXISTING SITE FEATURES AND ARE APPROXIMATE.
6. ALL CONCENTRATIONS ARE IN MICROGRAMS PER CUBIC METER ug/m^3.
7. J – THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

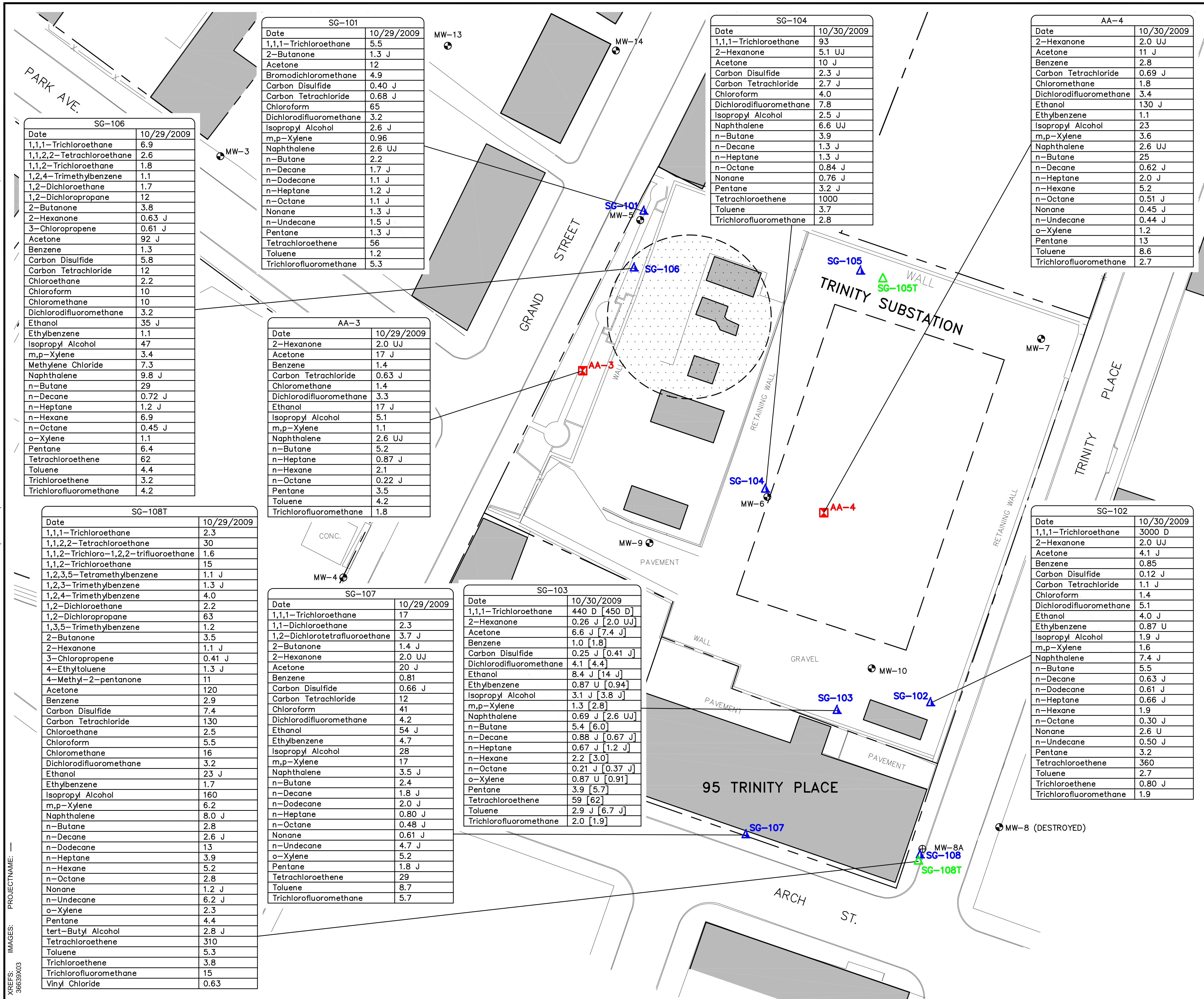
   UJ – THE COMPOUND WAS NOT DETECTED ABOVE THE REPORTED SAMPLE QUANTITATION LIMIT. HOWEVER, THE REPORTED LIMIT IS APPROXIMATE AND MAY OR MAY NOT REPRESENT THE ACTUAL LIMIT OF QUANTITATION.
8. VOC – VOLATILE ORGANIC COMPOUND.

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

SOIL-GAS ANALYTICAL RESULTS -- DETECTED VOC CONCENTRATIONS (ug/m^3) APRIL 2007

ARCADIS

FIGURE
13



SG-101	
Date	10/29/2009
1,1,1-Trichloroethane	5.5
2-Butanone	1.3 J
Acetone	12
Bromodichloromethane	4.9
Carbon Disulfide	0.40 J
Carbon Tetrachloride	0.68 J
Chloroform	65
Dichlorodifluoromethane	3.2
Isopropyl Alcohol	2.6 J
m,p-Xylene	0.96
Naphthalene	2.6 UJ
n-Butane	2.2
n-Decane	1.7 J
n-Dodecane	1.1 J
n-Heptane	1.2 J
n-Octane	1.1 J
Nonane	1.3 J
n-Undecane	1.5 J
Pentane	1.3 J
Tetrachloroethene	56
Toluene	1.2
Trichlorofluoromethane	5.3

SG-106	
Date	10/29/2009
1,1,1-Trichloroethane	6.9
1,1,2,2-Tetrachloroethane	2.6
1,1,2-Trichloroethane	1.8
1,2,4-Trimethylbenzene	1.1
1,2-Dichloroethane	1.7
1,2-Dichloropropane	12
2-Butanone	3.8
2-Hexanone	0.63 J
3-Chloropropene	0.61 J
Acetone	92 J
Benzene	1.3
Carbon Disulfide	5.8
Carbon Tetrachloride	12
Chloroethane	2.2
Chloroform	10
Chloromethane	10
Dichlorodifluoromethane	3.2
Ethanol	35 J
Ethylbenzene	1.1
Isopropyl Alcohol	47
m,p-Xylene	3.4
Methylene Chloride	7.3
Naphthalene	9.8 J
n-Butane	29
n-Decane	0.72 J
n-Heptane	1.2 J
n-Hexane	6.9
n-Octane	0.45 J
o-Xylene	1.1
Pentane	6.4
Tetrachloroethene	62
Toluene	4.4
Trichloroethene	3.2
Trichlorofluoromethane	4.2

SG-104	
Date	10/30/2009
1,1,1-Trichloroethane	93
2-Hexanone	5.1 UJ
Acetone	10 J
Carbon Disulfide	2.3 J
Carbon Tetrachloride	2.7 J
Chloroform	4.0
Dichlorodifluoromethane	7.8
Isopropyl Alcohol	2.5 J
Naphthalene	6.6 UJ
n-Butane	3.9
n-Decane	1.3 J
n-Heptane	1.3 J
n-Octane	0.84 J
Nonane	0.76 J
Pentane	3.2 J
Tetrachloroethene	1000
Toluene	3.7
Trichlorofluoromethane	2.8

AA-4	
Date	10/30/2009
2-Hexanone	2.0 UJ
Acetone	11 J
Benzene	2.8
Carbon Tetrachloride	0.69 J
Chloromethane	1.8
Dichlorodifluoromethane	3.4
Ethanol	130 J
Ethylbenzene	1.1
Isopropyl Alcohol	23
m,p-Xylene	3.6
Naphthalene	2.6 UJ
n-Butane	25
n-Decane	0.62 J
n-Heptane	2.0 J
n-Hexane	5.2
n-Octane	0.51 J
Nonane	0.45 J
n-Undecane	0.44 J
o-Xylene	1.2
Pentane	13
Toluene	8.6
Trichlorofluoromethane	2.7

AA-3	
Date	10/29/2009
2-Hexanone	2.0 UJ
Acetone	17 J
Benzene	1.4
Carbon Tetrachloride	0.63 J
Chloromethane	1.4
Dichlorodifluoromethane	3.3
Ethanol	17 J
Isopropyl Alcohol	5.1
m,p-Xylene	1.1
Naphthalene	2.6 UJ
n-Butane	5.2
n-Heptane	0.87 J
n-Hexane	2.1
n-Octane	0.22 J
Pentane	3.5
Toluene	4.2
Trichlorofluoromethane	1.8

SG-108T	
Date	10/29/2009
1,1,1-Trichloroethane	2.3
1,1,2,2-Tetrachloroethane	30
1,1,2-Trichloro-1,2,2-trifluoroethane	1.6
1,1,2-Trichloroethane	15
1,2,3,5-Tetramethylbenzene	1.1 J
1,2,3-Trimethylbenzene	1.3 J
1,2,4-Trimethylbenzene	4.0
1,2-Dichloroethane	2.2
1,2-Dichloropropane	63
1,3,5-Trimethylbenzene	1.2
2-Butanone	3.5
2-Hexanone	1.1 J
3-Chloropropene	0.41 J
4-Ethyltoluene	1.3 J
4-Methyl-2-pentanone	11
Acetone	120
Benzene	2.9
Carbon Disulfide	7.4
Carbon Tetrachloride	130
Chloroethane	2.5
Chloroform	5.5
Chloromethane	16
Dichlorodifluoromethane	3.2
Ethanol	23 J
Ethylbenzene	1.7
Isopropyl Alcohol	160
m,p-Xylene	6.2
Naphthalene	8.0 J
n-Butane	2.8
n-Decane	2.6 J
n-Dodecane	13
n-Heptane	3.9
n-Hexane	5.2
n-Octane	2.8
Nonane	1.2 J
n-Undecane	6.2 J
o-Xylene	2.3
Pentane	4.4
tert-Butyl Alcohol	2.8 J
Tetrachloroethene	310
Toluene	5.3
Trichloroethene	3.8
Trichlorofluoromethane	15
Vinyl Chloride	0.63

SG-107	
Date	10/29/2009
1,1,1-Trichloroethane	17
1,1-Dichloroethane	2.3
1,2-Dichlorotetrafluoroethane	3.7 J
2-Butanone	1.4 J
2-Hexanone	2.0 UJ
Acetone	20 J
Benzene	0.81
Carbon Disulfide	0.66 J
Carbon Tetrachloride	12
Chloroform	41
Dichlorodifluoromethane	4.2
Ethanol	54 J
Ethylbenzene	4.7
Isopropyl Alcohol	28
m,p-Xylene	17
Naphthalene	3.5 J
n-Butane	2.4
n-Decane	1.8 J
n-Dodecane	2.0 J
n-Heptane	0.80 J
n-Octane	0.48 J
Nonane	0.61 J
n-Undecane	4.7 J
o-Xylene	5.2
Pentane	1.8 J
Tetrachloroethene	29
Toluene	8.7
Trichlorofluoromethane	5.7

SG-103	
Date	10/30/2009
1,1,1-Trichloroethane	440 D [450 D]
2-Hexanone	0.26 J [2.0 UJ]
Acetone	6.6 J [7.4 J]
Benzene	1.0 [1.8]
Carbon Disulfide	0.25 J [0.41 J]
Dichlorodifluoromethane	4.1 [4.4]
Ethanol	8.4 J [14 J]
Ethylbenzene	0.87 U [0.94]
Isopropyl Alcohol	3.1 J [3.8 J]
m,p-Xylene	1.3 [2.8]
Naphthalene	0.69 J [2.6 UJ]
n-Butane	5.4 [6.0]
n-Decane	0.88 J [0.67 J]
n-Heptane	0.67 J [1.2 J]
n-Hexane	2.2 [3.0]
n-Octane	0.21 J [0.37 J]
o-Xylene	0.87 U [0.91]
Pentane	3.9 [5.7]
Tetrachloroethene	59 [62]
Toluene	2.9 J [6.7 J]
Trichlorofluoromethane	2.0 [1.9]

SG-102	
Date	10/30/2009
1,1,1-Trichloroethane	3000 D
2-Hexanone	2.0 UJ
Acetone	4.1 J
Benzene	0.85
Carbon Disulfide	0.12 J
Carbon Tetrachloride	1.1 J
Chloroform	1.4
Dichlorodifluoromethane	5.1
Ethanol	4.0 J
Ethylbenzene	0.87 U
Isopropyl Alcohol	1.9 J
m,p-Xylene	1.6
Naphthalene	7.4 J
n-Butane	5.5
n-Decane	0.63 J
n-Dodecane	0.61 J
n-Heptane	0.66 J
n-Hexane	1.9
n-Octane	0.30 J
Nonane	2.6 U
n-Undecane	0.50 J
Pentane	3.2
Tetrachloroethene	360
Toluene	2.7
Trichloroethene	0.80 J
Trichlorofluoromethane	1.9

LEGEND:

- MW-8A — MW-8 REPLACEMENT LOCATION INSTALLED JUNE 2009
- MW-7 — MONITORING WELL LOCATION
- SG-101 — PERMANENT SOIL-GAS SAMPLING LOCATION
- SG-108T — TEMPORARY SOIL GAS SAMPLING POINT
- AA4 — AMBIENT AIR SAMPLING LOCATION
- BUILDING/STRUCTURE
- —X—X— FENCE
- APPROXIMATE PROPERTY LINE
- APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NATIONAL GRID DURING JULY/AUGUST 2004 AND DECEMBER 2005.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.
3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.
4. U = CONSTITUENT NOT DETECTED AT A CONCENTRATION ABOVE THE REPORTED DETECTION LIMIT.
   UJ = THE COMPOUND WAS NOT DETECTED ABOVE THE REPORTED SAMPLE QUANTITATION LIMIT. HOWEVER, THE REPORTED LIMIT IS APPROXIMATE AND MAY OR MAY NOT REPRESENT THE ACTUAL LIMIT OF QUANTITATION.
   D = CONCENTRATION IS BASED ON A DILUTED SAMPLE ANALYSIS.
   J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.
5. SOIL-GAS SAMPLING LOCATION SG-105 WAS NOT SAMPLED DUE TO WATER IN THE SAMPLING TUBE.

0 60' 120'

GRAPHIC SCALE

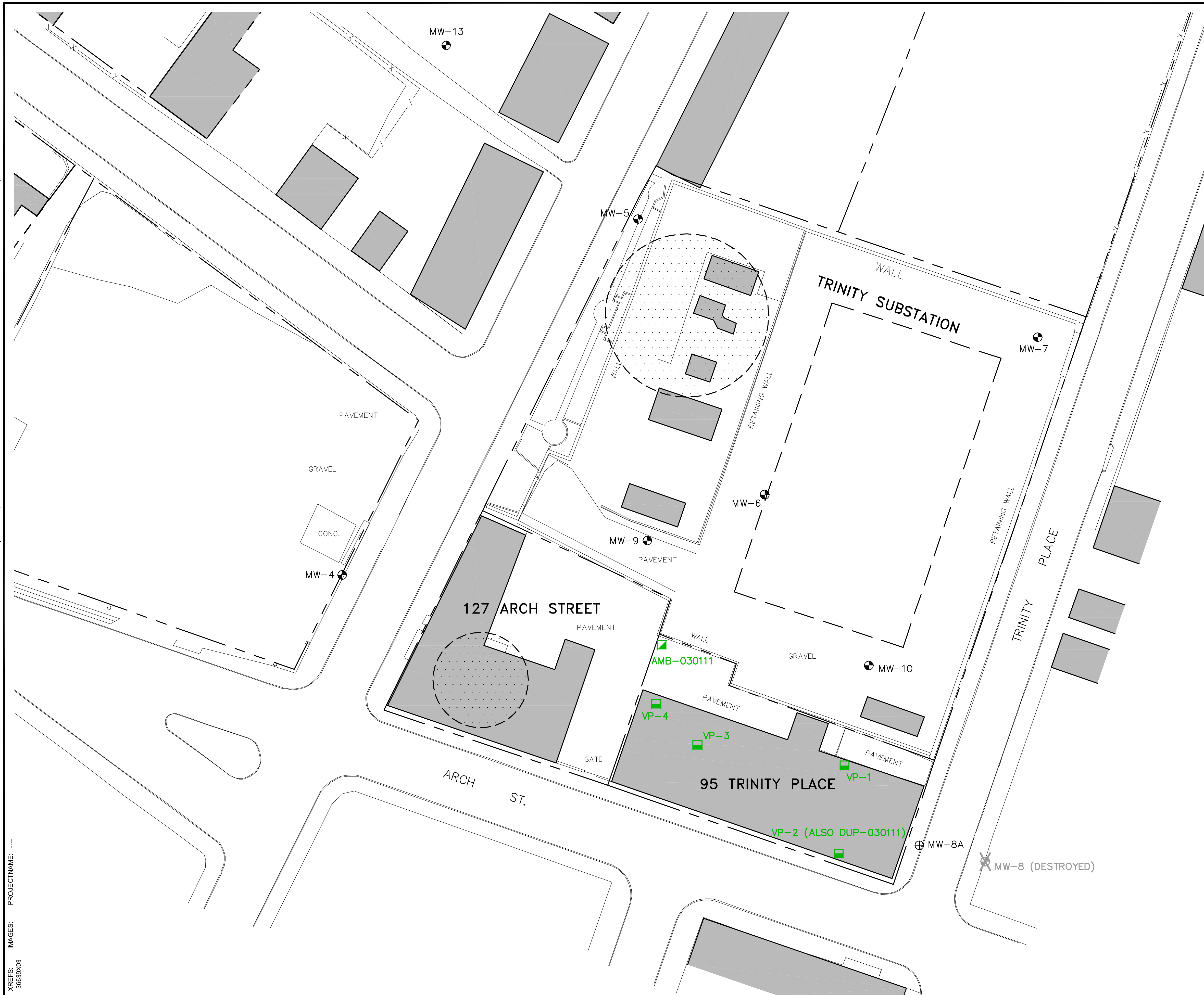
NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

SOIL GAS AND AMBIENT AIR SAMPLING RESULTS - OCTOBER 2009

ARCADIS

FIGURE
14

CITY: SYRACUSE, NY GROUP: ENVCAD DB: N. SMITHGALL, R. BASSETT PM/TM/TR: A. KORIK LYR: ON=*;OFF=REF (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0036639\0001\0015\DWG\SMP\36639C02.DWG LAYOUT: 14 SAVED: 2/24/2012 8:09 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/24/2012 8:09 AM BY: BASSETT, RICHARD
XREFS: 36639X03 IMAGES: PROJECTNAME: ----



LEGEND:

MW-8A ⊕	APPROXIMATE MONITORING WELL MW-8 REPLACEMENT LOCATION
MW-7	MONITORING WELL LOCATION
VP-2	APPROXIMATE SUBSLAB SAMPLING LOCATION
AMB-030111	APPROXIMATE OUTDOOR AMBIENT AIR SAMPLING LOCATION
	BUILDING/STRUCTURE
—X—X—	FENCE
— — —	APPROXIMATE PROPERTY LINE
	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NATIONAL GRID DURING JULY/AUGUST 2004 AND DECEMBER 2005.
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3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.

0 60' 120'

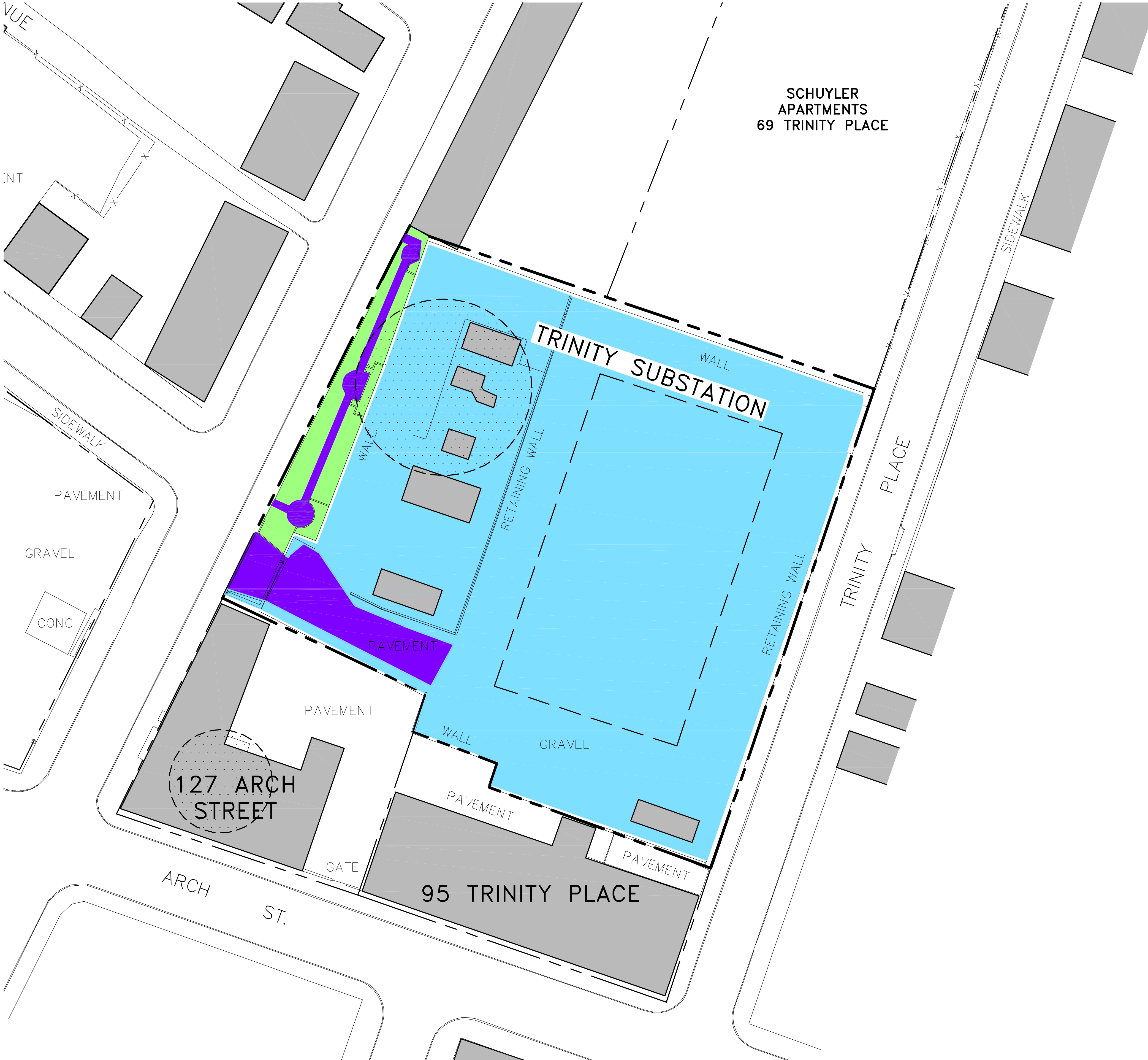
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

APPROXIMATE SUBSLAB SAMPLING LOCATIONS - BASEMENT OF 95 TRINITY PLACE BUILDING

ARCADIS

FIGURE
15



LEGEND:

- VEGETATIVE COVER
- GRAVEL COVER
- ASPHALT COVER
- BUILDING/STRUCTURE
- FENCE
- APPROXIMATE PROPERTY LINE

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 2004.

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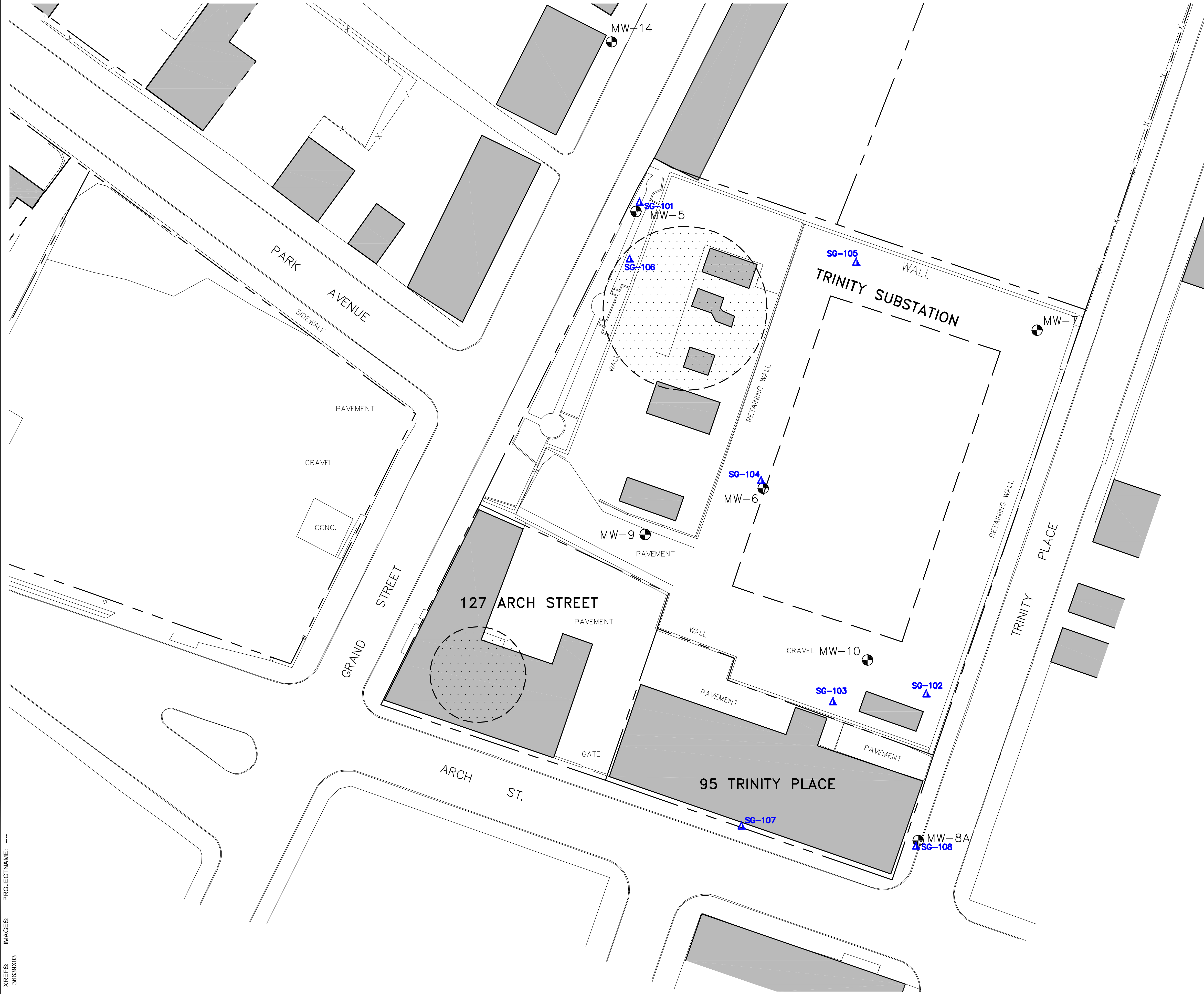
0 60' 120'
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

LOCATION OF COVER SYSTEM TYPES

ARCADIS

FIGURE
16



LEGEND:

MW-7	MONITORING WELL LOCATION
SG-101	PERMANENT SOIL-GAS SAMPLING LOCATION
	BUILDING/STRUCTURE
—x—x—	FENCE
— — —	APPROXIMATE PROPERTY LINE
	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NATIONAL GRID DURING JULY/AUGUST 2004 AND DECEMBER 2005.
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0 60' 120'

GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

GROUNDWATER MONITORING WELL NETWORK

ARCADIS

FIGURE **17**

Appendix A

Deed Restriction

DECLARATION of COVENANTS and RESTRICTIONS

THIS DECLARATION ("Declaration"), is made the 1ST day of AUGUST 2012, by **NIAGARA MOHAWK POWER CORPORATION**, a corporation of the State of New York, having its principal place of business at 300 Erie Boulevard West, Syracuse, New York 13202; and

WHEREAS, Niagara Mohawk Power Corporation is the owner ("Owner") of a parcel of real property located east of Grand Street, north of Arch Street, Tax Map ID's: 76.57-2-47, 48, 51 and 52, City of Albany, County of Albany, State of New York, being more particularly described in Appendix "A," attached to this Declaration and made a part hereof, and hereinafter referred to as the "Property"; and

WHEREAS, the Property is the subject of a certain Voluntary Cleanup Order, Index #D0-0001-0011, dated January 25, 2002, as part of the New York State Department of Environmental Conservation's (the "Department's") Manufactured Gas Plant Program; and

WHEREAS, the Department approved a remedy to eliminate or mitigate all significant threats to the environment presented by the contamination disposed at the Property and such remedy requires that the Property be subject to restrictive covenants; and

NOW, THEREFORE, Niagara Mohawk Power Corporation, for itself and its successors and/or assigns, covenants that:

First, the Property subject to this Declaration is as shown on a map attached to this Declaration as Appendix "B" and made a part hereof.

Second, unless prior written approval by the Department or, if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens (hereinafter referred to as the "Relevant Agency"), is first obtained, where contamination remains at the Property subject to the provisions of the approved Site Management Plan (the "SMP"), there shall be no construction, use or occupancy of the Property that results in the disturbance or excavation of the Property which threatens the integrity of the engineering controls, or which results in unacceptable human exposure to contaminated soils.

Third, the Owner of the Property shall not disturb, remove, or otherwise interfere with the installation, use, operation, and maintenance of engineering controls required for the remedy, which are described in the SMP, unless in each instance the Owner first obtains a written waiver of such prohibition from the Department or Relevant Agency.

Fourth, the Owner of the Property shall prohibit the Property from ever being used for purposes other than for Commercial Use without the express written waiver of such prohibition by the Department or Relevant Agency.

Fifth, the Owner of the Property shall prohibit the use of the groundwater underlying the Property without treatment rendering it safe for drinking water or industrial purposes, as appropriate, unless the user first obtains permission to do so from the Department or Relevant Agency.

Sixth, the Owner of the Property shall provide a periodic certification, prepared and submitted by a professional engineer or environmental professional acceptable to the Department or Relevant Agency, which will certify that the institutional and engineering controls put in place are unchanged from the previous certification, comply with the SMP, and have not been impaired.

Seventh, the Owner of the Property shall continue in full force and effect any institutional and engineering controls required for the remedy and maintain such controls, unless the Owner first obtains permission to discontinue such controls from the Department or Relevant Agency, in compliance with the approved SMP, which is incorporated and made enforceable hereto, subject to modifications as approved by the Department or Relevant Agency.

Eighth, this Declaration is and shall be deemed a covenant that shall run with the land and shall be binding upon all future owners of the Property, and shall provide that the Owner and its successors and assigns consent to enforcement by the Department or Relevant Agency of the prohibitions and restrictions that the SMP requires to be recorded, and hereby covenant not to contest the authority of the Department or Relevant Agency to seek enforcement.

Ninth, any deed of conveyance of the Property, or any portion thereof, shall recite, unless the Department or Relevant Agency has consented to the termination of such covenants and restrictions, that said conveyance is subject to this Declaration.

[Signature Page Follows]

IN WITNESS WHEREOF, the undersigned has executed this instrument the day written below.

Robert D. Teetz

Name: Robert D. Teetz

Title: Vice President, Environmental

::ODMA\PCDOCS\DOCS\316462\1

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

On the 1st day of August in the year 2012, before me, the undersigned, personally appeared Robert D Teetz, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name(s) 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 signatures(s) on the instrument, the individual(s), or the person on behalf of which the individual(s) acted, executed the instrument.

Notary Signature

Notary Stamp & Expiration Date:

FRANCIS J. MURPHY
Notary Public, State of New York
No. 02MU6242482
Qualified in Suffolk County
Commission Expires May 31, 2015

Appendix A

PARCEL & DEED RESTRICTION DESCRIPTION
DEC SITE NUMBER VO0466

ALL THAT TRACT OR PARCEL OF LAND situate in the City of Albany, County of Albany and State of New York and being more particularly bounded and described as follows:

Commencing at the intersection of the northerly highway boundary of Arch Street with the easterly highway boundary of Grand Street; thence N26°29'17"E along the easterly highway boundary of Grand Street a distance of 133.70 feet to the point and place of beginning, said point of beginning being the northwesterly corner the lands of Overlook Rentals, LLC (Liber 2802 Page 1055) and the southwesterly corner of the lands of Niagara Mohawk Power Corporation; thence N26°29'17"E along the easterly highway boundary of Grand Street a distance of 235.55 feet to a point standing on the division line between the lands of Niagara Mohawk Power Corporation on the south and the lands of Corey D. McQuinn (Liber 2732 Page 260) on the north; thence S61°46'19"E along last said division line as marked by the southerly face of the brick building on the lands of McQuinn a distance of 16.00 feet to an angle point; thence S71°09'11"E continuing along said division line and the division line between the lands of General Schuyler, LLC (Liber 3001 Page 613) on the north and the lands of Niagara Mohawk Power Corporation on the south a distance of 263.54 feet to a point on the westerly highway boundary of Trinity Place (Formerly Broad Street); thence S18°59'17"W along said highway boundary a distance of 287.50 feet to a point standing on the division line between the lands of Niagara Mohawk Power Corporation on the north and the lands of Capital City Rescue (Liber 2729 Page 1061) on the south; thence along last said division line the following three (3) courses and distances 1) N69°52'43"W a distance of 134.33 feet to a point, 2) N18°59'17"E a distance of 14.00 feet to a point and 3) N70°00'43"W a distance of 51.00 feet to a point standing on the division line between the lands of Niagara Mohawk Power Corporation and the lands of Overlook Rentals, Inc. (Liber 2802 Page 1055); thence along the last mentioned division line the following two (2) courses and distances: 1) N18°59'17"E a distance or 22.32 feet to a point and 2) N63°41'43"W a distance of 125.80 feet to the point and place of beginning. Containing 1.80± acres of land more or less.

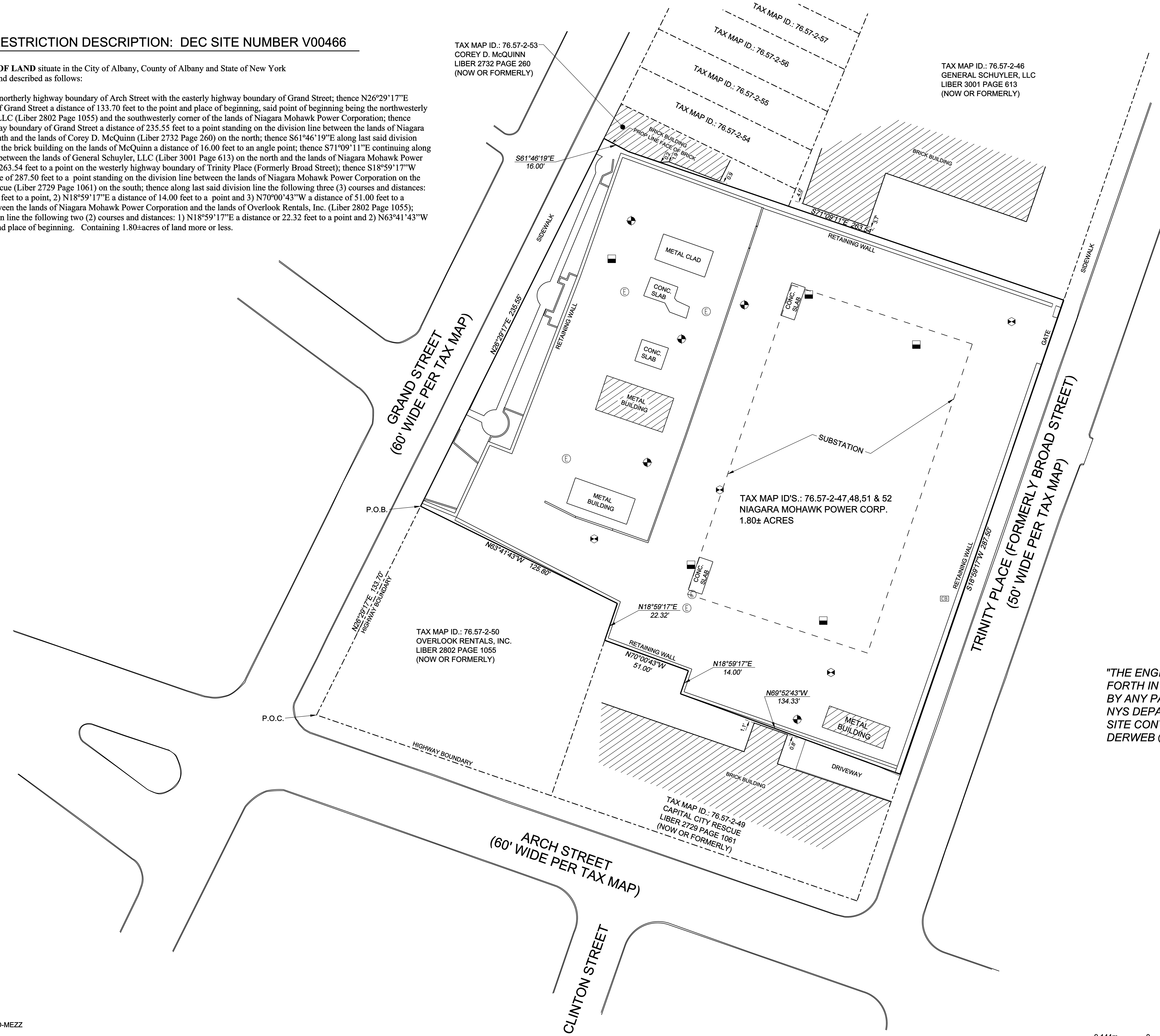
Appendix B

(Boundary Survey Trinity Substation, Prepared By Edward W. Donegan, Jr., Dated February 27, 2012)

PARCEL AND DEED RESTRICTION DESCRIPTION: DEC SITE NUMBER V00466

ALL THAT TRACT OR PARCEL OF LAND situate in the City of Albany, County of Albany and State of New York and being more particularly bounded and described as follows:

Commencing at the intersection of the northerly highway boundary of Arch Street with the easterly highway boundary of Grand Street; thence N26º29’17”E along the easterly highway boundary of Grand Street a distance of 133.70 feet to the point and place of beginning, said point of beginning being the northwesterly corner the lands of Overlook Rentals, LLC (Liber 2802 Page 1055) and the southwesterly corner of the lands of Niagara Mohawk Power Corporation; thence N26º29’17”E along the easterly highway boundary of Grand Street a distance of 235.55 feet to a point standing on the division line between the lands of Niagara Mohawk Power Corporation on the south and the lands of Corey D. McQuinn (Liber 2732 Page 260) on the north; thence S61º46’19”E along last said division line as marked by the southerly face of the brick building on the lands of McQuinn a distance of 16.00 feet to an angle point; thence S71º09’11”E continuing along said division line and the division line between the lands of General Schuyler, LLC (Liber 3001 Page 613) on the north and the lands of Niagara Mohawk Power Corporation on the south a distance of 263.54 feet to a point on the westerly highway boundary of Trinity Place (Formerly Broad Street); thence S18º59’17”W along said highway boundary a distance of 287.50 feet to a point standing on the division line between the lands of Niagara Mohawk Power Corporation on the north and the lands of Capital City Rescue (Liber 2729 Page 1061) on the south; thence along last said division line the following three (3) courses and distances: 1) N69°52’43”W a distance of 134.33 feet to a point, 2) N18º59’17”E a distance of 14.00 feet to a point and 3) N70º00’43”W a distance of 51.00 feet to a point standing on the division line between the lands of Niagara Mohawk Power Corporation and the lands of Overlook Rentals, Inc. (Liber 2802 Page 1055); thence along the last mentioned division line the following two (2) courses and distances: 1) N18º59’17”E a distance or 22.32 feet to a point and 2) N63º41’43”W a distance of 125.80 feet to the point and place of beginning.   Containing 1.80±acres of land more or less.



N

GRID NORTH

DATUM

HORIZONTAL AND VERTICAL DATUMS BASED ON GPS OBSERVATIONS.

HORIZONTAL: NYSPCS (NAD 83) EASTERN ZONE
VERTICAL: NAVD 88

TITLE DOCUMENTS	
LIBER	PAGE
371	105
711	363
724	121
2329	849

"THE ENGINEERING AND INSTITUTIONAL CONTROLS FOR THIS EASEMENT ARE SET FORTH IN THE SITE MANAGEMENT PLAN (SMP). A COPY OF THE SMP MUST BE OBTAINED BY ANY PARTY WITH AN INTEREST IN THE PROPERTY. THE SMP CAN BE OBTAINED FROM NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION, DIVISION OF REMEDIATION, SITE CONTROL SECTION, 625 BROADWAY, ALBANY, N.Y., 12233 OR AT DERWEB @GW.DEC.STATE.NY.US"

LEGEND

- NMPC PROPERTY LINES
- ADJOINER PROPERTY LINES
- CATCH BASIN
- ELECTRIC MANHOLE
- MONITORING WELL
- SOIL SAMPLE
- SOIL BORING

EDWARD W. DONEGAN, JR. , L.S.
300 ERIE BOULEVARD WEST, BLDG D-MEZZ
SYRACUSE, NEW YORK 13202.
315-428-5995

STATE OF NEW YORK
EDWARD W. DONEGAN JR.
NO. 049604
LICENSED LAND SURVEYOR

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

TO: THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION:

THE UNDERSIGNED HEREBY CERTIFIES THAT THIS MAP WAS PREPARED FROM NOTES OF AN ACTUAL FIELD SURVEY COMPLETED UNDER MY DIRECTION ON 02/10/2012.

EDWARD W. DONEGAN, JR. LS #049604 DATE

9.144m 0 9.144m 18.288m
SCALE: 1"=9.144 METERS

30 0 30 60
SCALE: 1"=30'

NO.	DATE	BY	DESCRIPTION OF REVISION	CK.	APP.

SURVEY PROJECT #3938.01

PREPARED BY

NIAGARA MOHAWK POWER CORPORATION
D.B.A. nationalgrid

BOUNDARY SURVEY
TRINITY SUBSTATION
LANDS OF NIAGARA MOHAWK POWER CORPORATION
CITY AND COUNTY OF ALBANY, N.Y.

DES. EWH	DR. EWH	CK. EWD	DATE: 02/27/12	SCALE: 1"=30'
APP.		APP.		INDEX:
APP.		APP.		NO. D-39166-E, SHEET 1 OF 1

ARCADIS

Appendix B

Excavation Work Plan

Imagine the result

Appendix B

Excavation Work Plan

Albany (Grand Street)
Non-Owned Former MGP Site

June 2012

Excavation Work Plan

Albany (Grand Street)
Non-Owned Former MGP Site

Prepared for:

National Grid

Prepared by:

ARCADIS of New York, Inc.
6723 Towpath Road
P O Box 66
Syracuse
New York 13214-0066
Tel 315 446 9120
Fax 315 449 0017

Our Ref.:

B0036639 #11

Date:

June 2012

ARCADIS

Table of Contents

1. Notification

At least 15 days prior to the start of any activity that is anticipated to encounter remaining MGP-impacted areas, the site owner or their representative will notify the Department. Currently, this notification will be made to:

Mr. R. Scott Deyette
Chief, Inspection Unit
Division of Environmental Remediation
NYSDEC
Remedial Action Bureau C - 11th Floor
625 Broadway
Albany, New York 12233-7014

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent, plans for site 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 (EC).
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of constituents of concern (COCs), potential presence of impacted media, and plans for any pre-construction sampling.
- A schedule for the work, detailing the start and completion of all intrusive work.
- A summary of the applicable components of this Excavation Work Plan (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 health and safety plan, in electronic format, if it differs from the HASP provided in Appendix C of the Site Management Plan (SMP).
- Identification of disposal facilities for potential waste streams.
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

2. Soil Screening Methods

Visual, olfactory and instrument-based soil screening will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially impacted material (remaining impacts). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the Certificate of Completion.

Soils will be segregated based on previous environmental data and screening results into material that requires offsite disposal, material that requires testing, material that can be returned to the subsurface, and material that can be used as cover soil.

Stockpiled potentially impacted soil/fill shall be sampled and analyzed to evaluate whether the material can be replaced beneath a soil cover at the Site or must be transported for offsite disposal. Samples will be collected and analyzed as described in Section 7.0.

3. Stockpile Methods

Soil stockpiles will be 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.

Stockpiles will be covered using polyethylene sheeting to reduce potential infiltration of precipitation, migration of wind-blown dust, and direct contact exposures. Stockpiles will be routinely inspected and damaged polyethylene sheeting will be promptly replaced. During future activities that may disturb the ground surface, erosion and sedimentation control measures shall be employed in accordance with site-specific plans (e.g., stormwater pollution prevention plans [Appendix I of the SMP]) prepared in conformance with applicable laws and regulations. Proven soil conservation practices shall be incorporated in any such plans in order to mitigate soil erosion, offsite sediment migration, and water pollution from erosion. Appropriate temporary erosion control measures (e.g., silt fencing, hay bales) shall be implemented and maintained around all impacted and potentially impacted soil/fill stockpiles and unvegetated soil surfaces at the Site during such activities. Such stockpiles shall be graded and compacted as necessary for positive surface water runoff and dust control.

Stockpiles will be inspected at a minimum frequency of once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by the New York State Department of Environmental Conservation (NYSDEC).

4. Materials Excavation and Load Out

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of excavated material.

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the Site will be investigated by the qualified environmental professional. 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.

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

Where necessary, a truck wash will be operated onsite. The qualified environmental professional will monitor that all outbound trucks will be washed at the truck wash before leaving the Site until the activities performed under this section are complete.

Locations where vehicles enter or exit the Site shall be inspected daily for evidence of offsite soil tracking.

The qualified environmental professional will be responsible for monitoring that all egress points for truck and equipment transport from the Site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

5. Materials Transport Off Site

All transport of materials designated for off-site disposal 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.

Material transported by trucks exiting the Site 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.

All trucks loaded with potentially MGP-impacted material will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of offsite in an appropriate manner.

Truck transport routes for soil and groundwater/decontamination water disposed as non-hazardous waste will utilize the most appropriate route and take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting offsite 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; and (g) community input [where necessary]. All trucks loaded with site materials will exit the vicinity of the Site using only these truck routes.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed onsite in order to minimize offsite disturbance. Offsite queuing will be prohibited.

6. Materials Disposal Off Site

All soil/fill/solid waste excavated and removed from the Site will be properly characterized. Where applicable, the waste will be treated as impacted and regulated material and will be transported for offsite disposal in accordance with all local, State (including 6 NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated offsite disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated offsite management of materials from this Site will not occur without formal NYSDEC approval.

Offsite disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate (i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc.). Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and impacted soils taken offsite will be handled, at minimum, as a Municipal Solid Waste per 6 NYCRR Part 360-1.2. Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6 NYCRR Part 360-16 Registration Facility).

7. Material Reuse On Site

Excavated soil/fill that is visibly stained or exhibits an obvious odor shall be considered potentially impacted and stockpiled onsite for further assessment. Potentially impacted soil/fill shall be placed on polyethylene sheeting in stockpiles not to exceed 250 cubic yards (CY). The stockpiled potentially impacted soil/fill 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 impacted soil/fill shall be sampled and analyzed to evaluate whether the material can be replaced beneath soil cover at the Site or must be transported for offsite disposal. One composite sample shall be collected for each 250 CY of potentially impacted soils. 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). 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 will be submitted for the following:

- TCL VOCs using USEPA Method 8260
- TCL SVOCs using USEPA Method 8270
- TAL inorganics and cyanide using USEPA Methods 6010, 7041, and 9012

Chemical criteria for onsite reuse of material will be the industrial SCOs presented in 6 NYCRR Part 375. The qualified environmental professional will document that procedures defined for material reuse in this SMP are followed and that unacceptable material does not remain onsite. Impacted onsite material, including historic fill and impacted soil, that is acceptable for re-use onsite will be placed below the cover system, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse onsite will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing onsite will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site will not be reused onsite.

8. Fluids Management

Efforts shall be made to minimize the amount of water that could enter the excavation (e.g., installing a berm around the excavation or covering the excavation to prevent runoff from entering during precipitation). Water accumulated in excavations within the Site shall be pumped out during or after precipitation events (as appropriate), containerized, and characterized as discussed below.

At a minimum, water encountered in excavations shall be sampled and analyzed for the COCs known to be in the area as determined by previous analytical results, which may include VOCs. Results shall be compared to the groundwater standards/guidance values set forth in TOGS 1.1.1. If the water meets the groundwater quality standards, it may be discharged to the ground surface. If the water does not meet the groundwater quality standards, it shall be discharged to the local sewer authority (if authorized), transported offsite for proper disposal, or treated onsite via a treatment system that has been approved by the NYSDEC, as appropriate. Runoff from surface discharges (if any) shall be controlled. No discharges shall enter a surface water body without proper permits.

All liquids to be removed from the Site, including excavation dewatering 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, without NYSDEC approval.

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 SPDES permit or temporary discharge authorization (if applicable).

9. Cover System Restoration

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., asphalt is replaced by soil cover), this will constitute a modification of the cover element of the remedy and the upper surface of the 'remaining impacted areas'. A figure showing the modified surface will be included in the subsequent Annual Review Report and in any updates to the SMP.

10. Backfill from Off-Site Sources

In the event fill material is imported from offsite sources to backfill subsurface excavations or provide a soil cover layer at the Site, imported material shall meet the following criteria:

- Offsite borrow soils shall be documented as having originated from locations having no evidence of disposal or release of hazardous, toxic or radioactive substances, wastes or petroleum products.

- Offsite borrow soils cannot otherwise be defined as a solid waste in accordance with 6 NYCRR Part 360-1.2(a).

- If an offsite source is designated as “virgin” soil, it shall be further documented in writing to be native soil material from areas not having supported any known prior industrial or commercial development or agricultural use.

- Virgin soils shall be subjected to collection of one representative composite sample (formed using individual grab samples collected from five locations) and one representative discrete sample per source. The composite sample shall be analyzed for PCBs, pesticides, TCL SVOCs, and TAL inorganic constituents (including cyanide). The discrete sample shall be analyzed for TCL VOCs. The soil shall be acceptable for use as soil cover material provided that no chemical constituents are identified at concentrations above applicable SCOs (e.g., 6 NYCRR Part 375 – Unrestricted Use). The material shall be acceptable for use as subsurface fill provided that no chemical constituents are identified at concentrations above the industrial use SCOs presented in 6 NYCRR Part 375 – 6.8.

- Non-virgin soils shall be tested via collection of one composite sample per 500 CY of material from each source area. If more than 1,000 CY of soil are borrowed from a given offsite non-virgin soil source area and both samples of the first 1,000 CY meet appropriate comparison criteria (e.g., 6 NYCRR Part 375 – Unrestricted or Industrial Use), the sample collection frequency shall be reduced to one composite for every 2,500 CY of additional soils from the same source, up to 5,000 CY. For borrow sources greater than 5,000 CY, sampling frequency may be reduced to one sample per 5,000 CY, provided all earlier samples met appropriate comparison criteria. The soil shall be acceptable for use as soil cover material provided that no chemical constituents are identified at concentrations above the unrestricted use SCOs presented in 6 NYCRR Part 375. The material shall be acceptable for use as subsurface fill provided that no chemical constituents are identified at concentrations above the industrial use SCOs presented in 6 NYCRR Part 375.

- Topsoil used for the final cover of the barrier layer shall be fertile, friable, natural loam surface soil, capable of sustaining plant growth, and free of clods or hard earth, plants or roots, sticks or other extraneous material that could discourage plant growth. Topsoil shall be seeded with a sustainable perennial mixture and appropriate erosion control measures shall be taken until the perennial grass is established.

All materials proposed for import onto the Site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the Site.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially impacted sites will not be imported to the Site.

All imported soils will meet the backfill and cover soil quality standards established in 6 NYCRR 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 this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

Trucks entering the Site 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.

11. Stormwater Pollution Prevention

The Stormwater Pollution Prevention Plan (SWPPP) is included as Appendix I. Minimum requirements under the SWPPP include:

- Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.

- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

- All 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.

12. Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, 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. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL inorganics; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history 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 to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected impacted media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the periodic reports prepared pursuant to Section 5 of the SMP.

13. Community Air Monitoring Plan

Air monitoring will be performed in accordance with the a project-specific CAMP. An example CAMP for on-going monitoring at the Site is included as Appendix D to the SMP.

Real-time air monitoring will be implemented at representative locations in the vicinity of the remedial activities for organic vapors. Upwind and downwind locations will be determined through observation of a wind sock that will be installed at the Site. Perimeter monitoring will include the use of a real-time organic vapor monitoring instruments. A summary of air monitoring procedures to be conducted are described below.

Organic vapors monitoring station locations will be determined daily based on the predominant wind direction indicated by the wind sock. An upwind location for organic vapors monitoring will be selected at the start of each workday. Two to three downwind (based on predominant wind direction) locations for volatile organic compounds (VOCs) monitoring will also be selected. The organic vapor monitoring stations will be deployed each day before the start of remedial activities. If wind direction shifts radically during the workday and for an extended period of time, such that the upwind location and both of the downwind locations no longer fall within acceptable guidelines (+/- 60° compass change from the original wind direction), the monitoring stations will be relocated so that the upwind and downwind locations are maintained. Air monitoring location changes will be documented in a field logbook.

Because real-time monitors for polycyclic aromatic hydrocarbons (PAHs) do not exist, the real-time VOC monitors will also serve as surrogate indicators of PAH emissions at the Site. As required by the NYSDOH Generic CAMP, VOCs will be monitored continuously during implementation of intrusive activities (e.g., excavation and materials handling activities) using instrumentation equipped with electronic data-logging capabilities. A real-time VOC monitor (MiniRAE 2000 [or equivalent]), equipped with either a photo-ionization detector (PID) calibrated to 10 ppm Isobutylene, or a flame-ionization detector (FID), will be used to conduct the monitoring for VOCs (and PAHs). All running average (15-minute intervals) concentrations and any instantaneous readings that support decisions regarding the remedial activities will be recorded using an electronic data logger and/or in the field logbook.

Action Levels

As outlined in the NYSDOH Generic CAMP, if the ambient air concentration of total VOCs at any one (or more) of the downwind perimeter locations exceeds 5 ppm above the background (upwind location) concentrations for a 15-minute average, intrusive activities will be temporarily halted while monitoring continues. If the total VOC concentration readily decreases (through observation of instantaneous readings) below 5 ppm above background, then intrusive activities can resume with continuous monitoring.

If the ambient air concentrations of total VOCs at any one (or more) of the downwind perimeter locations persist (despite cessation of work activities) at levels in excess of 5 ppm above background but less than 25 ppm above background, intrusive activities will be halted, the potential source(s) of the elevated VOC concentrations will be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will be continued. Once these actions have been performed, intrusive activities can resume provided that the total organic vapor (TOV) level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

If the ambient air concentrations of total VOCs at one (or more) of the downwind perimeter locations are above 25 ppm above background, the intrusive activities must cease, and emissions control measures must be implemented.

Exceedances of action levels listed in the project-specific CAMP will be reported to NYSDEC and NYSDOH Project Managers.

14. Odor Control Plan

This Odor Control Plan is capable of controlling emissions of nuisance odors offsite and onsite. Specific odor control methods to be used on a routine basis may include water/BioSolve® spray, polyethylene sheeting (for covering excavation faces, material stockpiles, etc.), minimizing excavation surface area to be exposed at any given time, and vapor suppression foam. If nuisance odors are identified at the 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 all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the contractor/party conducting the work. Any measures that are implemented will be discussed in the Annual Review Report.

All necessary means will be employed to prevent on- and offsite 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 offsite 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 onsite conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

15. Dust Control Plan

Dust monitoring will be performed in accordance with the project-specific CAMP.

Real-time air monitoring will be implemented at representative locations in the vicinity of the remedial activities for particulate matter less than 10 microns in diameter (PM10). Upwind and downwind locations will be determined through observation of a wind sock that will be installed at the Site. Perimeter monitoring will include the use of a real-time particulate monitoring instrument. A summary of dust monitoring procedures to be conducted are described below.

PM10 monitoring station locations will be determined daily based on the predominant wind direction indicated by the wind sock. An upwind location for PM10 monitoring will be selected at the start of each workday. Two to three downwind (based on predominant wind direction) locations for PM10 monitoring will also be selected. The PM10 monitoring stations will be deployed each day before the start of remedial activities. If wind direction shifts radically during the workday and for an extended period of time, such that the upwind location and both of the downwind locations no longer fall within acceptable guidelines (+/- 60° compass change from the original wind direction), the monitoring stations will be relocated so that the upwind and downwind locations are maintained. Dust monitoring location changes will be documented in a field logbook.

Fugitive dust migration will be visually assessed during work activities, and reasonable dust suppression techniques will be used during Site activities that may generate fugitive dust.

As required by the NYSDOH Generic CAMP, real-time airborne particulate monitoring will be conducted continuously during intrusive activities, including soil excavation, backfilling, and related soil handling. Particulate monitoring will be conducted using instrumentation equipped with electronic data-logging capabilities. Particulate monitoring will also serve as a surrogate indicator of PAH emissions at the Site. A MIE DataRAM (or equivalent) will be used to conduct the real-time PM10 monitoring. Concentration readings will be recorded using an electronic data logger and/or in the field logbook.

Action Levels

As required by the NYSDOH Generic CAMP, if the ambient 15-minute average PM10 air concentration at any one (or more) of the downwind perimeter locations is noted at levels in excess of 100 micrograms per cubic meter (µg/m3) above the background concentration, or if airborne dust is visually observed leaving the work area, then dust suppression activities will be implemented, and air monitoring will continue. Work may continue following the implementation of dust-suppression techniques provided the PM10 levels do not exceed 150 µg/m3 above background, and no visible dust is observed migrating from the work areas.

If, after implementation of dust-suppression techniques, the downwind PM10 levels are greater than 150 µg/m3 above background, work must be stopped and Site activities must be re-evaluated. Once additional actions have been implemented, work may resume only if dust-suppression measures and other controls are successful in reducing the 15-minute average PM10 levels to less than 150 µg/m3 above background at the downwind perimeter of the Site and if no visible dust is observed migrating from the work area.

A dust suppression plan that addresses dust management during invasive onsite work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated onsite water truck for road wetting. The truck will be equipped with a water cannon 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.

- Onsite roads will be limited in total area to minimize the area required for water truck sprinkling.

ARCADIS

Appendix A

Appendix Title

Appendix B

Appendix Title

ARCADIS

Appendix C

Health and Safety Plan

Infrastructure, environment, buildings

Imagine the result

Environmental Health and Safety Plan (E-HASP)

Albany (Grand Street)
Non-Owned Former MGP Site

September 2003, updated June 2009

Designated H&S Plan Writer

Designated H&S Plan Reviewer

Project Manager

Environmental Health and Safety Plan (E-HASP)

Albany (Grand Street)
Non-Owned Former MGP Site

Prepared for:
National Grid

Prepared by:
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Our Ref.:
B0036639 #10

Date:
June 2009

Figures

Appendices

Approvals and Acknowledgments

Approvals

I have read and approved this Health and Safety Plan (HASP) with respect to project hazards, regulatory requirements, and ARCADIS procedures.

Project Name: National Grid – Albany (Grand Street) Non-Owned Former MGP Site

Project Number: B0036639.0000.00010

6/5/2009
Project Manager/Date

6/5/2009
Health and Safety Manager

Health and Safety Supervisor/Date

Acknowledgments

The final approved version of this HASP has been provided to the site supervisor. I acknowledge my responsibility to provide the site supervisor with the equipment, materials and qualified personnel to implement fully all safety requirements in this HASP. I will formally review this plan with the Health and Safety Staff every 6 months until project completion.

6/5/2009
Project Manager/Date

I acknowledge receipt of this HASP from the project manager, and that it is my responsibility to explain its contents to all site personnel and cause these requirements to be fully implemented. Any change in conditions, scope of work, or other change that might affect worker safety requires me to notify the project manager and/or the health and safety officer.

Site Supervisor/Date

Memorandum of Acknowledgement

To: ARCADIS

From "Subcontractor": *Parratt-Wolff, Inc.*

Date: *June 5, 2009*

Re: Subcontractor Health and Safety Plan

Pursuant to its obligations under the referenced Site and Project, Subcontractor submits the following **as the** Subcontractor's Health and Safety Plan ("HASP") for the following project and client:

Client: National Grid	**Site Name: Grand Street, Albany**
Project Name: Grand Street Investigation	**ARCADIS Project Number: B0036639**
Start Date: June 9, 2009	**End Date: June 30, 2009**

Subcontractor acknowledges that it is responsible for the health and safety of its workers and others relating to the Subcontractor's Work and Site. The Subcontractor is required to submit its Health and Safety Plan for its Work. To comply with its requirements, the Subcontractor represents that its Health and Safety Plan for its Work shall include the Subcontractor's compliance (including compliance by Subcontractor's employees, officers, agents, representatives, invitees, and sub-subcontractors) with the ARCADIS Health and Safety Plan, together with any further amendments to such plan particular to the Subcontractor's Work and Site deemed necessary and appropriate by the Subcontractor.

Subcontractor agrees and understands that ARCADIS claims no responsibility for the use of the HASP and ARCADIS does not represent that the HASP is sufficient to address the Work or Site conditions of the Subcontractor. Subcontractor shall not hold ARCADIS responsible for any claims arising from the Subcontractor's use of the HASP and agrees to indemnify, defend and hold harmless ARCADIS from any claims for personal injury or property damages arising from or related to the compliance with, utilization or application, or any alleged deficiencies of the HASP. Nothing herein, including the use by Subcontractor of the HASP or acknowledgment of the Subcontractor's HASP shall create any duty, obligation, liability, or responsibility of ARCADIS for any act or failure to act in respect to any safety provision of the HASP and the Subcontractor shall remain solely responsible for the health and safety of Subcontractor, its employees or any person entering the Subcontractor's Work Site.

Signed: *for Parrat-Wolff, Inc.*

By: William Morrow

Name: William Morrow
Title: Vice President
Date: 6/5/09

ARCADIS
Infrastructure, environment, buildings

Health and Safety Plan Acknowledgment

I have read the Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents and I agree to abide by its requirements.

Name (Print)	Signature	Representing	Date

1. Introduction

All work on this project will be carried out in compliance with ARCADIS' Health and Safety policies and procedures, and the Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response regulation 29 CFR 1910.120. The design of this Health and Safety Plan (HASP) conforms to the requirements of the ARC HSFS010 (HASP H&S Procedure). Specific health and safety information for the project is contained in this HASP. All personnel working on hazardous operations or in the area of hazardous operations shall read and be familiar with this HASP before doing any work. All project personnel shall sign the certification page acknowledging that they have read and understand this HASP.

Changes in the scope of the project or introduction of new hazards to the project shall require revision of the HASP by the HASP writer and reviewer, and approval by the Project Manager. The HASP Addendum Form and log table are included as Appendix A.

2. Project Site History and Requirements

2.1 Site Background

The Grand Street parcel (Figures 1 and 2) of the Albany (Grand Street) non-owned former MGP site is bordered by Grand Street to the west, residential buildings and a multistory apartment building (the Schuyler Apartments, which was previously a school) to the north, Trinity Place to the east, and Arch Street to the south. The National Grid Trinity Substation occupies the northern portion of the Grand Street parcel and vacant multistory industrial buildings (the former F. Jacobson & Sons Shirt Factory) occupy the southern portion of the parcel. The substation is surrounded by an approximately 10-foot-high concrete wall. Access to the substation is restricted by locked gates located in the southwest (along Grand Street) and northeast (along Trinity Place) corners of the substation. Access to the southern portion of the parcel (the industrial buildings) is limited, with the exception of one driveway located along Arch Street which services a loading dock on the north side of the building.

Based on conversations with National Grid substation personnel during a previous site visit and drawings provided by National Grid, the primary electrical voltage that feeds the substation is 115 KV. Primary features at the substation include:

- three large oil-filled electrical transformers located in the central portion of the site.
- five banks of oil-filled circuit breakers located in the eastern portion of the site.
- a metal control building located in the western portion of the site.
- two enclosed electrical switch gear structures and one 4 KV distribution structure (referred to as “metal clad” buildings) located to the south and north of the control building.
- one natural gas-fired emergency generator (used for backup switching power) located in the southeast portion of the site.

Current site use includes the substation, an automobile garage, a junkyard, a NAPA Auto Parts store and maintenance garage and, a wholesale beverage distributor.

2.2 Site Description

Site Type: (Check as many as applicable}

x	Active	x	Secure	x	Industrial		Landfill		Service station
	Inactive		Unsecured	x	Commercial		Well field		Water work
			Uncontrolled		Residential		Railroad		Undeveloped
Other specify:									

The three parcels that comprise the site encompass the historical holdings of the former Albany Gas Light Company. The historical information indicates that the original MGP operation was located on the Grand Street parcel of the site and that the parcels located north and south of Park Avenue were utilized for gas holders. Historical use of the Albany Gas Light Company buildings located along Warren and Phillip Streets is not well documented.

2.3 List of Project Tasks and Scope of Work

2.3.1 Task 1 – Subsurface and Overhead Utility Clearance

Dig Safe New York will be notified at least three business days prior to the intended start of work. Additionally, ARCADIS personnel will conduct a ground penetrating radar (GPR) survey of proposed boring locations prior to advancement of borings. All boring locations will then be hand-cleared using an air-knife or other approved soft-dig technology to a depth of 5 feet below ground surface per ARCADIS Utility Clearance Protocol (ARCHSFS019). Field personnel will also note the presence of overhead utilities located in proximity to each boring location. The proposed soil vapor monitoring points and the replacement well locations shown on Figure 3 will be adjusted in the field as necessary based on the presence of subsurface and overhead utilities. For the three locations proposed in the sidewalk, ARCADIS will coordinate the acquisition of appropriate street opening permits with the City of Albany.

2.3.2 Task 2 – Installation and Sampling of Eight Soil Vapor Points

Each soil vapor point will be installed to depths of 6 to 7 feet below ground surface (bgs). Groundwater monitoring wells in proximity to each soil vapor point will be gauged for depth to groundwater immediately prior to installation of the soil vapor point. The completion depth of the vapor point will be adjusted if groundwater is encountered at depths of less than 7 feet bgs. Soil vapor sampling point installation and sampling procedures will be performed in general conformance with Appendix A of National Grids Standard Operating Procedure entitled *Soil Vapor Intrusion Evaluation at National Grid MGP Sites in New York State*, 2007. The permanent soil vapor monitoring points will be constructed by advancing steel drive rods and installing an expendable stainless steel drive point and screen at the target subsurface depth(s) using an AMS 9600 direct-push PowerProbe rig. The drive point and screen will be connected to food grade Teflon® or polyethylene tubing (nominally ¼-inch outer diameter). As the drive rods are withdrawn, the stainless steel drive point and screen will remain at the bottom of the boring with the connected tubing extending above the ground surface. Following emplacement of each soil vapor monitoring point, the void space around the screen and tubing will be filled with glass beads to a height of approximately 1 foot above the top of the screen. Approximately 1 foot of dry bentonite will be placed on top of the glass beads and hydrated bentonite slurry will be placed in the remaining annular space to approximately 1 foot below grade and a permanent, flush-mounted protective curb box will be installed and sealed into place with cement.

In order to minimize the potential for contamination to be introduced during the installation process, all downhole equipment will be decontaminated prior to installing the first soil vapor point and between each point. Each stainless steel drive point and screen will be decontaminated by immersion in a solution of detergent and water and thoroughly rinsed prior to installation. Tubing will be new and still “in the wrap” and stored in a re-sealable plastic baggie prior to being brought to the site.

Soil vapor sampling will be performed no sooner than 48 hours following installation of the permanent soil vapor points to allow for equilibration. Prior to collecting each soil vapor sample, the sampling point and tubing will be purged (one to three volumes) using a syringe. PID readings will be obtained and recorded in the field notebook during the purging activities. A helium tracer gas will be used as a QA/QC tool to verify the integrity of the soil vapor probe seal and to confirm that infiltration of outdoor air is not occurring. An inverted plastic bucket will be used as an enclosure to keep the tracer gas in contact with the probe during integrity testing as described in the New York State Department of Health (NYSDOH) guidance document entitled *Guidance for Evaluating Soil Vapor Intrusion in the State of New York, Final*, October 2006.

Laboratory-supplied 6-liter SUMMA canisters will be used to collect the soil vapor samples from each sampling point. The flow controller/regulator on the SUMMA canister will be connected to the inert Teflon® or polyethylene tubing and the soil vapor samples will be collected over an approximately 2-hour interval. The valve on the flow controller will be closed when the vacuum reading reaches -6 inches Hg. The SUMMA regulators will be calibrated by the analytical laboratory to collect soil vapor samples at a flow rate not to exceed 0.2 liters per minute. The soil vapor samples will be submitted to TestAmerica Laboratory located in Knoxville, Tennessee for analysis for National Grid/project-specific VOCs in accordance with United States Environmental Protection Agency (USEPA) Method TO-15. TestAmerica is certified by the NYSDOH for Method TO-15 analysis.

In addition to the subsurface soil vapor samples, one outdoor ambient air sample will be collected per day during soil vapor sampling to characterize site-specific ambient (i.e., background) outdoor air concentrations. The ambient air samples will be collected over an approximately 2-hour time period concurrent with the collection of the subsurface soil vapor samples. The ambient air sample locations will be selected in the field to provide representative upwind locations for the soil vapor samples collected at the Trinity Substation. Ambient air samples will be collected from approximately 3 feet above ground surface. The outdoor ambient air samples will be collected using laboratory-supplied SUMMA canisters and analyzed as described above for soil vapor samples.

The locations of the permanent soil vapor points and ambient samples will be surveyed for inclusion on an updated site map. Surface horizontal coordinates will refer to the New York State Plane Central (3102) coordinate system (North American Datum [NAD] 83) with elevations referenced to North American Vertical Datum (NAVD) 88.

2.3.3 Task 3 – Replacement of One Overburden Groundwater Monitoring Well

In order to evaluate downgradient groundwater characteristics, a groundwater monitoring well (Labeled MW-8A on Figure 3) will be installed adjacent to the former location of monitoring well MW-8, which was previously destroyed. The monitoring well will be installed by first advancing a boring to a depth of approximately 25 feet below ground surface using 4.25-inch inner-diameter hollow-stem augers. The monitoring well will be constructed by placing a 15-foot section of 2-inch diameter, schedule 40 PVC well screen (0.010 slot size) coupled to a 10-foot section of solid riser into the boring. The annulus around the screened interval will be backfilled with #0 sand to two feet above the top of the screen, with 6 inches of #00 sand placed on top of the #0 sand. 2 feet of bentonite will be placed on top of the sand pack and hydrated. The remainder of the annulus will be filled with cement/bentonite grout and the well will be finished at the surface with an 8-inch flush-mount curb box. The well was also fitted with a 2-inch locking J-plug cap. A measuring point will be marked at the top of the PVC riser.

At least 24 hours after installation, the new monitoring well will be developed by surging and bailing/overpumping. Development will continue until the water removed from the well is reasonably free of visible sediment (50 nephelometric turbidity units [NTUs]), or until the turbidity levels stabilize following a minimum removal of 3 to 5 well volumes.

The location and top of casing elevation for the new monitoring well will be surveyed following installation. Surface horizontal coordinates will refer to the New York State Plane Central (3102) coordinate system (North American Datum [NAD] 83) with elevations referenced to North American Vertical Datum (NAVD) 88.

2.3.4 Task 4 – Gauging and Sampling of Nine Groundwater Monitoring Wells

(including eight existing wells and the new replacement well to be installed)

Groundwater samples will be collected from 5 monitoring wells MW-5, MW-6, MW-7, MW-9 and MW-10, which are located at the Trinity Substation parcel. Groundwater samples will also be collected from upgradient monitoring wells MW-3, MW-4 and MW-14, and the new replacement monitoring well MW-8A. The groundwater samples will be submitted to TestAmerica (Shelton, Connecticut laboratory) for analysis.

ARCADIS will use disposable bailers to purge the monitoring wells prior to sampling. Field parameters (i.e., pH, conductivity, dissolved oxygen, temperature, turbidity, and oxidation-reduction potential) will be measured approximately every five minutes during purging. Groundwater samples submitted for laboratory analysis for VOCs will be collected using a disposable polyethylene bailer.

Groundwater samples will be placed in an iced cooler immediately after collection. Samples will be labeled and shipped to TestAmerica under proper chain of custody protocol.

3. ARCADIS Organization and Responsibilities

3.1 Roles and Responsibilities

3.1.1 All Personnel

All ARCADIS and subcontractor personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner conflicting with these procedures. After due warnings, the PM will dismiss from the site any person who violates safety procedures.

All ARCADIS personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all personnel will attend an initial hazard briefing prior to beginning work at the site.

The roles of ARCADIS personnel are outlined in the following subsections. A summary table for key project personnel and contacts is provided below.

Table 3-1. Key Personnel

Client Key Personnel		
Title/Role	**Name**	**Address/Telephone No.**
Client/On-Site Rep.	James F. Morgan	300 Erie Boulevard West Syracuse, NY 13202 315.428.3101
ARCADIS Key Personnel		
Title/Role	**Name**	**Address/Telephone No.**
Project Manager	Michael C. Jones	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 315.671.9211
Site Supervisor/ Health and Safety Supervisor	Andrew Korik	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 315.671.9323
Health and Safety Officer	Charles P. Webster, CSP	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 315.671.9297, Cell 315.247.5971
Project Officer	James M. Nuss	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214 (315) 671-9230

Subcontractor Personnel		
Company/Role	**Name**	**Address/Telephone No.**
Parratt-Wolff, Inc. - Driller	William Morrow	5879 Fisher Road P.O. Box 56 East Syracuse, NY 13057 (315) 437-1429

3.2 ARCADIS Personnel

3.2.1 Health and Safety Officer

The HSO has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding ARCADIS health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSO or his/her designee must approve changes or addenda to this HASP.

3.2.2 Project Manager

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the site supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP. It is also the responsibility of the PM to perform the following duties:

- Consult with the HSO on site health and safety issues.
- Review Loss Prevention Observation (LPO) reports.
- Verify that all incidents are thoroughly investigated.
- Approve, in writing, addenda or modifications to this HASP.
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

3.2.3 Health and Safety Supervisor

The health and safety supervisor (HSS) is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSS will advise the PM on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary (see Section 7.1, Air Monitoring). The HSS is the primary site contact on health and safety matters. It is the responsibility of the HSS to perform the following duties:

- Provide on-site technical assistance, if necessary.
- Participate in all incident investigations (IIs) and confirm that they are reported to the HSO and PM within 24 hours.
- Coordinate site and personal air monitoring, as required, including equipment maintenance and calibration.
- Conduct site safety orientation training and safety meetings.
- Verify that ARCADIS personnel have received the required physical examinations and medical certifications.
- Review site activities with respect to compliance with this HASP.
- Maintain required health and safety documents and records.
- Assist the SS in instructing field personnel on project hazards and protective procedures.
- Review LPO forms.

3.2.4 Site Supervisor

The SS is responsible for implementing this HASP, including communicating requirements to on-site personnel. The SS will be responsible for informing the PM of changes in the work plan, procedures, or site conditions so that those changes may be addressed in this HASP. Other responsibilities are to perform the following duties:

- Consult with the HSS on site health and safety issues.
- Conduct LPOs at the site.
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance.
- Obtain a site map, determine and post routes to medical facilities, and post emergency telephone numbers.
- Notify local public emergency representatives (as appropriate) of the nature of the site operations and post their telephone numbers (e.g., local fire department personnel who would respond for a confined-space rescue).
- Observe on-site project personnel for signs of ill-health effects.
- Investigate and report any incidents to the HSS.
- Verify that all on-site personnel have completed applicable training.
- Verify that on-site personnel are informed of the physical, chemical, and biological hazards associated with the site activities and the procedures and protective equipment necessary to control the hazards.
- Issue/obtain any required work permits (hot work, confined space, etc.).

3.3 All On-Site Personnel

All on-site personnel must read and acknowledge their understanding of this HASP before commencing work, and abide by the requirements of the HASP. All on-site personnel must sign the HASP Acknowledgement Form after reviewing this HASP.

All ARCADIS personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all on-site personnel will attend an initial hazard briefing (prior to beginning work at the site) and the daily safety meetings.

All on-site personnel must perform TRACK prior to beginning each work activity. Safety issues should be either eliminated or mitigated prior to starting work. Risk assessment must also be performed after any near-miss or other incident to determine if it is safe to proceed. On-site personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses, no matter how minor
- Unexpected or uncontrolled release of chemical substances
- Symptoms of chemical exposure
- Unsafe or hazardous situations
- Unsafe or malfunctioning equipment
- Changes in site conditions that may affect the health and safety of project personnel
- Damage to equipment or property
- Situations or activities for which they are not properly trained
- Near misses

No employees will be allowed to enter areas designated as high-voltage unless accompanied by an authorized National Grid employee. Only National Grid employees trained and authorized to work around high voltage equipment will be allowed to work in close proximity of high voltage line or to de-energize equipment.

3.4 Visitors

All visitors to ARCADIS work areas must check in with the SS. Visitors will be cautioned to avoid contact with any materials that may be, or are suspected to be, impacted by constituents of concern (COCs).

Visitors requesting to observe work at the site must don appropriate personal protective equipment (PPE) prior to entering the work area, and must have the appropriate training and medical clearances to do so.

4. Hazard Control

HARC – RISK ASSESSMENT MATRIX (H&S PROCEDURE ARC HSMS002)

Risk Assessment Matrix

Consequences Ratings*		Likelihood Ratings**				
		A	B	C	D	E
People	Property	Never heard of in the world	Heard of incident in industry	Incident has occurred in ARCADIS Group	Happens several times a year in ARCADIS OpCo	Happens several times a year at ARCADIS Worksite
0 - No health effect	0 - No damage	Low	Low	Low	Low	Low
1 - Slight health effect	1 - Slight damage	Low	Low	Low	Low	Low
2 - Minor health effect	2 - Minor damage	Low	Low	Low	Medium	Medium
3 - Major health effect	3 - Local damage	Low	Low	Medium	Medium	High
4 - PTD or 1 fatality	4 - Major damage	Low	Medium	Medium	High	High
5 - Multiple fatalities	5 - Extensive damage	Medium	Medium	High	High	High

The Hazard Analysis Worksheet is provided in Appendix B of this HASP.

4.1 Job Safety Analyses (JSAs), H&S Procedures and PPE

A JSA has been completed for each safety critical task, and are included in Appendix C. Hazards identified on the Project Hazard Analysis Worksheet are addressed in the JSAs as well as control methods to protect employees and property from hazards. The JSA also lists the type of personal protective equipment (PPE) required for the completion of the project. A detailed list of PPE for the project is located in Appendix D.

ARCADIS H&S Procedures applicable to this project are listed below. These procedures should be reviewed by the project manager, task manager and site personnel. The Client H&S Resource should be contacted with any questions concerning the procedures.

- ARC HSFS019 – Utility Location
- ARC HSIH003 – Benzene
- ARC HSFS006- Electrical Safety
- ARC HSGE024- Defensive Driving

4.2 Project Hazards and Control Measures

4.2.1 Introduction

Field activities will include the following tasks:

- Mobilization/Site Survey
- Ground Penetrating Radar (GPR) Survey
- Borehole Clearance Using Air Knife
- Soil Boring Installation and Sampling
- Installation of Monitoring Wells
- Monitoring Well Development
- Groundwater Sampling
- Soil Vapor Sampling
- Decontamination
- Demobilization

The following job safety analyses (JSAs) identify potential health, safety, and environmental hazards associated with each type of field activity listed above. Because of the complex and changing nature of field projects, supervisors must continually inspect the site to identify hazards that may affect on-site personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep on-site personnel informed of the changing conditions and the PM will write and/or approve addenda or revisions to this HASP as necessary.

Each field activity is described below, and potential hazards and control measures for each activity are discussed.

4.2.2 Mobilization/Site Survey

Site mobilization will include establishing sampling locations, determining the location of utilities and other installations, and establishing work areas. During this initial phase, project personnel will walk the site to confirm the existence of anticipated hazards, and identify safety and health issues that may have arisen since the writing of this plan.

4.2.2.1 Hazards

- Vehicular and pedestrian traffic
- Proximity to high voltage
- Slip/trip/fall

Environmental hazards include:

- Plants, such as poison ivy and poison oak
- Aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes
- Weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses
- Pathogens, such as rabies, Lyme disease, and blood-borne pathogens

4.2.2.2 Control

Control procedures for these hazards are discussed in Section III (E, F, H, I, M, N, AA) of the ARCADIS Employee Field Health & Safety Handbook. Environmental hazards are discussed in greater detail in Section 5 of this HASP. Personnel will wear Class 2 safety vests at all times while conducting site visits.

4.2.3 Ground Penetrating Radar (GPR) Survey

The GPR Survey will involve traversing the site with a portable GPR unit.

4.2.3.1 Hazards

The major hazard will involve vehicular traffic along the adjacent roadways and proximity to high voltage. Environmental hazards are described in *Section 4.2.2.1* above.

4.2.3.2 Control

Control procedures for these hazards are discussed in Section III (E, F, H, I, M, N, AA, KK, LL, MM) of the ARCADIS Employee Field Health & Safety Handbook. Site personnel will isolate the work area with barricades, signs, cones, caution tape, or other appropriate means to alert pedestrians and passing motorists to the presence of an active work area. Personnel will wear Class 2, high-reflectivity safety vests/shirts. Work will not be performed at night or in low light conditions.

4.2.4 Borehole Clearance

This task will involve manually clearing boreholes to a depth of 5 feet below grade using an air knife.

4.2.4.1 Hazards

In addition to the hazards described above, task-specific hazards include working with high pressure air-lines, noise, and the potential for being struck by high-velocity projectiles.

4.2.4.2 Control

In addition to the control measures described in *Section 4.2.3.2* above, all personnel will wear hearing and eye protection while the air knife is operating. Personnel operating the air-knife will wear full face shields. The nozzle of the air knife will never be pointed towards personnel. Crews will maintain eye contact while air knifing. A barrier will be placed over the hole while the air knife is operating to minimize the potential for projectiles to be ejected from the hole. The air knife will be inspected according to the manufacturer's instructions prior to use. The inspection will be documented.

4.2.5 Soil Boring and Soil Vapor/Groundwater Monitoring Well Installation

This task includes drilling, installing and developing groundwater monitoring wells.

4.2.5.1 Hazards

Installing soil borings and monitoring wells to collect soil samples may involve the use of conventional drill rig or direct-push-type boring equipment (Geoprobe® or equivalent). The equipment poses a hazard if it is not properly operated. Direct-push equipment is hydraulically powered and uses static force and dynamic percussion force to advance small-diameter sampling tools. The presence of overhead utilities and underground obstacles poses a hazard if boring equipment contacts them. As the hazards are similar to those encountered when using a conventional drill rig, the required control procedures are also the same as a conventional rig and are discussed below. The primary physical hazards for this activity are associated with the use of drilling equipment, since tools and equipment (such as elevators, cat lines, and wire rope) have the potential for striking, pinning, or cutting personnel.

- *Cat Lines* — Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat-line operations may injure the employee doing the rigging, as well as the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

- *Materials Handling* — The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift and/or fall from a pipe rack or truck bed.

- *Rig Accidents* — Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to starting operations.

- *Utility Lines* — Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment.

- *Wire Rope* — Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

- *Working Surfaces* — Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

4.2.5.2 Controls

In addition to the general safety practices as described in the ARCADIS Employee Field Health and Safety Handbook, the following control procedures are required for this activity:

- *Drill Crews* — All drillers must possess applicable state or local licenses, as required to perform drilling work. All members of the drill crew must receive site-specific training prior to beginning work. The driller is responsible for the safe operation of the drill rig, as well as the crew's adherence to the requirements of this HASP. The driller must confirm that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear appropriate PPE, and be aware of all hazards and control procedures. The drill crews must participate in the daily safety meetings and be aware of all emergency procedures.

- *Rig Inspection* — Each day, prior to starting work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. The following items must be inspected:

  - Vehicle condition
  - Proper storage of equipment
  - Condition of all wire rope and hydraulic lines
  - Fire extinguisher
  - First-aid kit

- *Drill Rig Set Up* — The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels that remain on the ground must be chocked even if the rig's parking brake has been applied. The leveling jacks must not be raised until the derrick is lowered. The rig should be moved only after the derrick has been lowered.

- *Site Drilling Rules* — Before drilling activities commence, the existence and location of underground pipe, electrical equipment, and gas lines will be determined by methods described previously. The ARCADIS Utility Clearance Protocol (ARCHSFS019) and its associated Utility Clearance Checklist (Appendix E) will be used to document that nearby utilities have been marked on the ground and that the excavation and drilling areas have been cleared. The completed Underground/Overhead Utility Checklist will be in the possession of the SS prior to commencing any intrusive investigation.

  The following additional site drilling rules apply to project sites:

  - Combustible gas readings of the general work area will be made regularly (see Section 7).

  - Operations must be suspended and corrective action taken if the airborne flammable concentration reaches 10% of the LEL in the immediate area (a 1-foot radius) of the point of drilling, or near any other ignition sources.

  - Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the cat line be used as a personnel carrier.

- *Overhead Electrical Clearances* — If drilling activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up, and guaranteed, or the equipment must be positioned such that no part (including the excavation boom) can come within the minimum clearances as shown below.

Minimum Overhead Electrical Clearances (All Equipment)

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV, and 16 feet for voltages above 345kV.

- *Rig Set Up* — Three control procedures apply to rig set up:

  - All well sites will be inspected by the driller prior to establishing the location of the rig to verify that a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

  - All rigs will be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking confirms that differential settling of the rig does not occur. Wheels remaining on the ground will be chocked and the parking brake will be applied.

  - When the ground surface is soft or otherwise unstable, wooden blocks at least 24 inches by 24 inches and 4 inches to 8 inches thick must be placed between the jack swivels and the ground. The emergency brake must be engaged and the wheels that are on the ground must be chocked.

- *Hoisting Operations* — The following control procedures apply to hoisting operations:

  - Drillers should never engage the rotary clutch without watching the rotary table so that it is clear of personnel and equipment.

- Unless the drawworks is equipped with an automatic-feed control, the brake should not be left unattended without first being tied down.

- Auger strings or casing should be picked up slowly.

- During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.

- The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.

- A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment unless it has been specifically designed for line contact.

- Workers should never stand near the borehole whenever any wire-line device is being run.

- Hoisting control stations should be kept clean and controls labeled as to their functions.

• *Cat-Line Operations* - The following control procedures apply to cat-line operations:

- Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operating the cat line. The cathead area must be kept free of obstructions and entanglements.

- The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

- Personnel should not stand near, step over, or go under a cable or cat line that is under tension.

- Employees rigging loads on cat lines must:

  ✓ Keep out from under the load.

  ✓ Keep fingers and feet where they will not be crushed.

  ✓ Be sure to signal clearly when the load is being picked up.

  ✓ Use standard visual signals only and not depend on shouting to co-workers for communication.

  ✓ Make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load.

- *Wire Rope* — The following control procedures apply to the use of wire rope:

  - When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope must be removed from service or resocketed. Special attention must be given to the inspection of end fittings on boom support, pendants, and guy ropes.

  - Wire rope removed from service due to defects must be cut up or plainly marked as being unfit for further use as rigging.

  - Wire rope clips attached with U-bolts must have the U-bolts on the dead or short end of the rope; the clip nuts must be retightened immediately after initial load carrying use and at frequent intervals thereafter.

  - When a wedge socket fastening is used, the dead or short end of the wire rope must have a clip attached to it or looped back and secured to itself by a clip; the clip must not be attached directly to the live end.

  - Protruding ends of strands in splices on slings and bridles must be covered or blunted.

  - Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads must consist of one continuous piece without knot or splice.

- An eye splice made in any wire rope must have not less than five full tucks.

- Wire rope must not be secured by knots. Wire rope clips must not be used to splice rope.

- Eyes in wire rope bridles, slings, or bull wires must not be formed by wire clips or knots.

- *Auger Handling* — The following control procedures apply to auger handling:

  - Auger sections must be transported by cart or carried by two persons. Individuals should not carry auger sections without assistance.

  - Workers should not be permitted on top of the load while loading, unloading, or transferring rolling stock.

  - When equipment is being hoisted, personnel should not stand where the bottom end of the equipment could whip and strike them.

  - Augers stored in racks, catwalks, or on flatbed trucks should be secured to prevent rolling.

4.2.5.3 Direct-Push Hazards and Controls

Direct-push equipment (such as Geoprobe®) is hydraulically powered and uses static force and dynamic percussion force to advance small-diameter sampling tools. As the hazards are similar to those encountered when using a conventional drill rig, the required control procedures are also the same as a conventional rig presented in the previous section.

4.2.6 Monitoring Well Development

Field operations will consist of developing the well after installation to remove material or contaminants from the well prior to its being placed in service.

4.2.6.1 Hazards

The physical hazards of monitoring well development are primarily associated with manipulating and operating the pump and its associated equipment. Other physical hazards of this phase of activity are associated with site conditions and manual materials handling.

Equipment operation may present noise and vibration hazards, and the potential for employee contact with hot surfaces. Manual materials handling may cause blisters, sore muscles, and joint and/or skeletal injuries. The work area may present slip, trip, and fall hazards from scattered debris and wet or irregular walking surfaces. Wet weather may cause wet, muddy, and/or slick walking surfaces. Exposure to soil and water containing COCs is also possible. Purge water will be stored in 55-gallon drums, which must be handled and managed.

Environmental hazards are similar to those described previously.

4.2.6.2 Control

To control dermal exposure during monitoring well development activities, a minimum of Modified Level D protection will be worn. Air monitoring will be conducted during groundwater sampling and monitoring activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Section 7.1, Air Monitoring, describes air monitoring requirements and action levels. Drums will be moved using an appropriate drum cart. Care will be taken during opening and closing drums so that pinch-points will be avoided.

4.2.7 Field Sampling

The following field sampling activities will be undertaken during this project:

- Groundwater sampling
- Soil sampling
- Soil vapor sampling

4.2.7.1 Groundwater Sampling

Groundwater sampling will involve uncapping, purging (pumping water out of the well), sampling, and monitoring new or existing monitoring wells. A mechanical pump may be used to purge the wells and can be hand-, gas-, or electric-operated. Water samples taken from the wells are then placed in containers and shipped to analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the sample collection methods and procedures used.

4.2.7.1.1 Hazards

Inhalation and absorption of COCs are the primary routes of entry associated with groundwater sampling, due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During this project, several different groundwater sampling methodologies may be used based on equipment accessibility and the types of materials to be sampled. These sampling methods may include hand or mechanical bailing. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with groundwater sampling procedures are generally limited to strains or sprains from hand bailing, and potential eye hazards. Exposure to water containing COCs is also possible.

Environmental hazards may include poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

4.2.7.1.2 Control

To control dermal exposure during groundwater sampling activities, a minimum of Modified Level D protection will be worn. Air monitoring will be conducted during groundwater sampling to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Section 7.1, Air Monitoring, describes air monitoring requirements and action levels.

4.2.7.2 Soil Sampling

This task involves collecting soil samples for subsequent analysis and evaluation of potential impact by COCs. Samples will be collected from split-spoon samplers during advancement of monitoring well borings. The physical hazards of these operations are primarily associated with the sample collection methods as well as drilling operations as previously described.

4.2.7.2.1 Hazards

Inhalation and absorption of COCs are the primary routes of entry associated with soil sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. The hazards directly associated with soil sampling procedures are generally limited to strains or sprains, and potential eye hazards. Exposure to soil containing COCs is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles (especially large vehicles with limited operator visibility), is a concern. Of particular concern will be the backing up of trucks, rigs, and other support vehicles.

Environmental hazards have been described in preceding sections.

4.2.7.2.2 Control

To control dermal exposure during soil sampling activities, a minimum of Modified Level D protection will be worn. Avoid laying tools and equipment on the ground to avoid contact with native poisonous or irritating flora and fauna. Air monitoring will be conducted during soil sampling activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Each level of personal protection is described in Appendix D. Control procedures for environmental and general hazards are discussed in Section 5, General Safety Practices. Safety hazards and procedures associated with activities conducted around excavations are presented in the following subsections.

4.2.7.3 Soil Vapor Sampling

Soil vapor sampling will involve collecting samples in 6-liter evacuated SUMMA canisters. The samples are then shipped to an analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the sample collection methods and procedures utilized.

4.2.7.3.1 Hazards

Inhalation of COCs are the primary route of entry associated with soil vapor sampling due to the manipulation of sample media and equipment, and proximity of operations to the breathing zone. The hazards associated with soil vapor sampling procedures are generally limited to strains/sprains from lifting. Stainless steel canisters associated with the sampling are received under a vacuum, therefore, care should be taken not to drop or damage the canister risking injury. Exposure to soil containing COCs is also possible. The sampling protocol involves using helium as a field check for leaks in the sampling train. Thus, precautions for working with compressed gasses as outlined in Section III (HH) of the ARCADIS Field Health and Safety Handbook should be reviewed and followed.

Environmental hazards have been previously described.

4.2.7.3.2 Control

To control dermal exposure during the soil vapor sampling activities, a minimum of Modified Level D will be worn. The vapor points should be approached, opened and sampled from the upwind side. A photoionization detector (PID) will be used to determine exposure potential to the worker. If necessary, based on field observations and site conditions, air monitoring may be conducted during soil vapor sampling activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 7.1, Air Monitoring, for a description of air monitoring requirements and action levels.

4.2.8 Equipment Decontamination

4.2.8.1 Hazards

All equipment will be decontaminated before leaving the site using visual inspection to verify that COCs have been removed. Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the site as part of the project work. Steam pressure washers present burn and projectile hazards. In addition all operations that have the potential to generate or release hazardous material will be conducted in a controlled area using the appropriate engineering controls. Specific decontamination techniques will be established based on site conditions.

4.2.8.2 Control

Decontamination procedures will be reviewed with all personnel on-site. The majority of decontamination activities will utilize 5-gallon buckets with a soap and water wash. Pressure washing with manual scrub brushing as needed will be used to decontaminate augers. Pressure cleaning will take place over a decontamination pad. Decontamination water and materials will be contained in 55-gallon drums and temporarily stored in a secure area on site pending disposal. Personnel conducting pressure washing will wear full face shields and leather gloves.

4.2.9 Demobilization

Demobilization involves the removal of all tools, equipment, supplies, and vehicles brought to the site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

4.2.9.1 Hazards

Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards, and hot surfaces, to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Driving risks are associated with motor vehicle operations.

Environmental hazards have been described previously.

4.2.9.2 Control

Control measures are similar to those described for mobilization in Section 4.2.2.

4.3 Field Health & Safety Handbook

The Field H&S Handbook is an ARCADIS document containing information about topic-specific health and safety requirements for the field. This handbook contains relevant general topics and is used as part of the overall HASP process. To aid in the consistency of the HASP process the handbook will be used as an informational source in conjunction with this HASP. The following four (4) handbook sections are minimally required reading for this project:

- Section III-E. General Health and Safety Rules
- Section III-F. General Housekeeping, Personal Hygiene and Field Sanitation
- Section III-G. Site Security, Work Zone and Decontamination for HAZWOPER Sites
- Section III-GG. HAZWOPER and HAZMAT Response

- Section III-I Severe Weather
- Section III-L Noise
- Section III-M Heat and Cold Stress
- Section III-N Biological Hazards
- Section III-R Personal Protective Equipment
- Section III-T Vehicle Safety Inspection
- Section III-U Driving
- Section III-AA Electrical Safety
- Section III-HH Compressed Gas Cylinder Handling, Storage and Use
- Section III-II. Drums and other Material Handling
- Section III-KK Signs, Signals and barricades
- Section III-LL Traffic Control
- Section III-MM Utility Location

5. General Safety Practices

5.1 Loss Prevention System

The LPS is a behavior based safety system meant to prevent or reduce the occurrence of injury, illness, or other incident. This program seeks the prevention or reduction of losses by:

- emphasizing proactive activities.
- capitalizing on the on-the-job expertise of field employees.
- maximizing the use of positive reinforcement.
- integrating with daily field operations.
- solving problems from the bottom up while providing direction from the top down.

Prior to assignment on a project in the field, ARCADIS personnel that will be performing or overseeing work on this project must attend an LPS training session. This training session explains the objectives, elements, and requirements of LPS.

5.1.1 Loss Prevention Self Assessment (TRACK)

All on-site personnel are required to perform TRACK prior to beginning any activity. This three-step process requires each individual to:

- *Assess* the risk of the task to be performed by **T**hinking through the task, **R**ecognizing the hazards, and **A**nalyzing the risks. Ask the following questions:
  - What could go wrong?
  - What is the worst thing that could happen if something does go wrong?
- *Analyze* the ways the risk can be reduced by **C**ontrolling the hazards. Ask the following questions:
  - Do I have all the necessary training and knowledge to do this task safely?
  - Do I have all the proper tools and PPE?

- *Act* to control the risk and perform the task safely by **K**eeping H&S 1st in everything you do.

  - Take the necessary action to perform the job safely.
  - Follow written procedures, and ask for assistance if necessary.

This process must be performed prior to beginning any activity and must be performed after any Near Loss or other incident in order to determine if it is safe to proceed.

5.2 Motor Vehicle Safety

All ARCADIS and subcontractor personnel will be aware of the ARCADIS Driver Safety Program. All ARCADIS personnel are graduates of Smith System training. All ARCADIS and subcontractor drivers must have a valid driving license, and be familiar with the site-specific driving JLA. Section III of the ARCADIS Employee Field Health & Safety Handbook (T, U) presents additional driving safety materials.

5.3 Buddy System

On-site personnel must use the buddy system as required by operations. Use of the buddy system is required during all operations requiring Level C to Level A PPE, and when appropriate, during Level D operations. Crew members must observe each other for signs of chemical exposure and heat or cold stress. Indications of adverse effects include, but are not limited to:

- changes in complexion and skin coloration
- changes in coordination
- changes in demeanor
- excessive salivation and pupillary response
- changes in speech pattern

Crew members must also be aware of the potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.

Field personnel must inform their partners or fellow crewmembers of non-visible effects of exposure to toxic materials that they may be experiencing. The symptoms of such exposure may include, but are not limited to:

- headaches
- dizziness
- nausea
- blurred vision
- cramps
- irritation of eyes, skin, or respiratory tract

If protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

Additionally, ARCADIS and subcontracted personnel will be continuously accompanied by a National Grid representative while working inside the secure area of the Trinity Substation.

5.4 Heat Stress

Heat stress is caused by several interacting factors, including environmental conditions, clothing, and workload, as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be able to recognize the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses, and be able to recognize the signs and symptoms of these illnesses in themselves and their coworkers.

5.4.1 Heat Rashes

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules (bumps) 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.

5.4.2 Heat Cramps

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be related to a lack of water replenishment. Excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a sign of the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquid, such as Gatorade is effective in minimizing physiological disturbances during recovery.

5.4.3 Heat Exhaustion

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include:

- pale, cool, moist skin
- heavy sweating
- dizziness
- nausea
- headache
- vertigo
- weakness
- thirst
- giddiness

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, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, given fluid replacement, and be encouraged to get adequate rest.

5.4.4 Heat Stroke

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails, and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are:

- hot, dry skin
- confusion
- irrational behavior
- loss of consciousness
- convulsions
- a lack of sweating (usually)
- an abnormally high body temperature (e.g., a temperature greater than 104 degrees Fahrenheit [°F]).

If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first-aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

5.4.5 Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. Screening criteria for heat stress exposure and examples of activities within metabolic rate categories are described below.

Work/Rest Schedule

	Acclimatized				Unacclimatized			
Work Demands	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% Work	85.1ºF (29.5ºC)	81.5ºF (27.5ºC)	78.8ºF (26ºC)	--	81.5ºF (27.5ºC)	77ºF (25ºC)	72.5F (22.5ºC)	--
75% Work; 25% Rest	86.9ºF (30.5ºC)	83.3ºF (28.5ºC)	81.5ºF (27.5ºC)	--	84.2ºF (29ºC)	79.7ºF (26.5ºC)	76.1ºF (24.5ºC)	--
50% Work; 50% Rest	88.7ºF (31.5ºC)	85.1ºF (29.5ºC)	83.3ºF (28.5ºC)	81.5ºF (27.5ºC)	86ºF (30ºC)	82.4ºF (28ºC)	79.7ºF (26.5ºC)	77ºF (25ºC)
25% Work, 75% Rest	90.5ºF (32.5ºC)	87.8ºF (31ºC)	86ºF (30ºC)	85.1ºF (29.5ºC)	87.8ºF (31ºC)	84.2ºF (29ºC)	82.4ºF (28ºC)	79.7ºF (26.5ºC)

Source: 2004 TLVs and BEIs – Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: ACGIH, 2004 – page 171.

Example Activities within Metabolic Ranges

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on a level at 6 kilometers per hour while carrying 3 kilograms weight load

Categories	Example Activities
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

Source: 2004 TLVs and BEIs – Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: ACGIH, 2004 – page 172.

Acclimatization is a set of physiological adaptations that allows the body to react to heat stress conditions. Full-heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued and a noticeable loss occurs after 4 days. With a recent history of heat stress exposures (e.g., 5 of the last 7 days), a worker can be considered acclimatized for the purpose of using the table Screening Criteria for Heat Stress Exposure.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.

- On-site drinking water will be kept cool (50 to 60°F).

- A work regimen that will provide adequate rest periods for cooling down will be established, as required.

- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.

- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.

- Employees should be instructed to monitor themselves and coworkers for signs of heat stress and to take additional breaks as necessary.

- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek™-type garments.

All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

5.5 Cold Stress

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Body areas that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold-weather injury: ambient temperature and wind velocity. For instance, a temperature of 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. An equivalent chill temperature chart relating the actual dry-bulb temperature and wind velocity is presented below.

Wind Chill Temperature Chart

Estimated Wind Speed (in mph)	Actual Temperature Reading (ºF)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (ºF)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	Little Danger Maximum danger of false sense of security.				Increasing Danger Danger from freezing of exposed flesh within one minute.			Great Danger Flesh may freeze within 30 seconds.				
	Trench foot and immersion foot may occur at any point on this chart.											

(This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA [Source: ACGIH TLV Handbook, ACGIH, 2002a]).

Local injury resulting from cold is included in the generic term “frostbite.” There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities falls into the following categories:

- *Frost Nip or Incipient Frostbite* – Characterized by sudden blanching or whitening of skin.
- *Superficial Frostbite* – Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- *Deep Frostbite* – Tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages:

- shivering
- apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F
- unconsciousness, glassy stare, slow pulse, and slow respiratory rate
- freezing of the extremities
- death

Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first-aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be used to prevent cold stress.

5.5.1 Cold Stress Safety Precautions

The following safety precautions should be followed to prevent cold stress:

- For air temperature of 0°F or less, mittens should be used to protect the hands. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.

- At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.

- If work is done at a normal temperature or in a hot environment before entering the cold, the field personnel must confirm that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.

- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

Field personnel handling evaporative liquid (e.g., gasoline, alcohol, and cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

5.5.2 Safe Work Practices

The following safe work practices must be employed to prevent cold stress:

- Direct contact between bare skin and cold surfaces (less than 20°F) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

- For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

- Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.

- Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

5.6 Lightning

Outdoors is the most dangerous place to be during a lightning storm. When lightning is seen or thunder is heard, or when dark clouds are observed, quickly move indoors or into a hard-topped vehicle and remain there until well after the lightning storm ends. Listen to forecasts and warnings through NOAA Weather Radio or your TV and radio stations. If lightning is forecast, plan an alternate work activity or know where you can take cover quickly. Adhere to the following precautionary items regarding lightning:

1. **Postpone activities promptly. Don't wait for rain.** Many people take shelter from the rain, but most people struck by lightning are not in the rain! Go quickly inside a completely enclosed building, not a carport, open garage or covered patio. If no enclosed building is convenient, get inside a hard-topped all-metal vehicle. A cave is a good option outside but move as far as possible from the cave entrance.

2. **Be the lowest point. Lightning tends to hit the tallest object.** In the mountains if you are above tree line, you ARE the highest object around. Quickly get below tree line and get into a grove of small trees. Don't be the second tallest object during a lightning storm! Crouch down if you are in an exposed area.

3. **Keep an eye on the sky.** Look for darkening skies, flashes of lightning, or increasing wind, which may be signs of an approaching thunderstorm.

4. **Listen for the sound of thunder.** If you can hear thunder, go to a safe shelter immediately.

5. **If you see or hear a thunderstorm coming or your hair stands on end, immediately suspend work and instruct everyone to go inside a sturdy building or car.** Sturdy buildings are the safest place to be. Avoid sheds, picnic shelters, baseball dugouts, and bleachers. If no sturdy building is nearby, a hard-top vehicle with windows closed will offer some protection. The steel frame of the vehicle provides some protection if you are not touching metal. Work should not be resumed until at least 30 minutes have passed since thunder has been heard or lightning has been seen.

6. **Listen to the Weather Radio**. Listen for alerts.

7. **Set up Weather Alerting**. ARCADIS has a lightning and severe weather alerting system that, when enabled for a specific project site, sends automated text messages to cell phones when lightning is occurring within 25 miles of project sites.

8. **If you can't get to a shelter, stay away from trees.** If there is no shelter, crouch in the open, keeping twice as far away from a tree as it is tall.

9. **Avoid leaning against vehicles**. Get off bicycles and motorcycles.

10. **Get out of the water. It's a great conductor of electricity.** Stay off the beach and out of small boats. If caught in a boat, crouch down in the center of the boat away from metal hardware. Wading and scuba diving are NOT safe. Lightning can strike the water and travel some distance beneath and away from its point of contact. Don’t stand in puddles of water, even if wearing rubber boots.

11. **Avoid metal!** Drop metal backpacks, stay away from clothes lines, fences, exposed sheds and electrically conductive elevated objects. Don't hold on to metal items such golf clubs, fishing rods, tennis rackets or tools. Large metal objects such as drill rigs or excavators can conduct lightning. Small metal objects can cause burns.

12. **Move away from a group of people.** Stay several yards away from other people. Don't share a bleacher bench or huddle in a group.

Make sure you are not the highest object. Lighting tends to strike the highest object. Crouch down. Do not lie down! What you most want to avoid is lightning going through your heart. Lightning follows the path of least resistance. If lightning strikes the ground near you, a ground current will set up in the area nearby. If you are lying flat your chances of being “hit” by this ground lightning increases. Not only that, the lightning will run through your whole body including your heart. If you are in a crouching position with your heels together, the ground current will enter one foot but it will then return to the ground through your other foot on the ground. The current does not go through your heart.

5.7 Carbon Monoxide

When working indoors or in an excavation with any type of gasoline, diesel or LP gas powered equipment; carbon monoxide (CO) is a significant hazard. Recognize that a single generator, propane heater or propane fork truck can quickly generate CO above the permissible exposure level regardless of the size of the room. The following guidelines will mitigate any carbon monoxide issues.

- Utilize remotely powered equipment whenever possible. Validate that the exhaust from the generating unit is not being sucked or blown back into the building.
- Use an approved exhaust extension for stationary work. Run the extension to the outside of the building.
- Do not use unvented gas or kerosene space heaters in enclosed spaces.
- When operating any fossil-fueled equipment indoors ensure that all pre-operation equipment checks are completed and that the equipment is running to specifications. Smokey exhaust, sputtering, backfires, etc., all indicate an equipment problem requiring immediate service.
- Provide ventilation within the building regardless of the weather outdoors. Open vents and intakes as well as entry and overhead doors.

- Utilize large fans to move air into or out of the building. Sometimes you get better results blowing air out than bringing it in. For stationary work be sure to move fresh air through the breathing zone of employees.

- Operate a properly calibrated CO meter (Such as the Multi-Rae) within the worker breathing zone before, during and after equipment operation. Recognize that a CO alarm requires immediate action. Stop work, shut down engines and move to the outdoors until the alarm subsides and it is safe to reenter. Exposure guidelines for CO are listed in Section 7.4, Action Levels.

5.7.1 Symptoms of Carbon Monoxide Exposure

CO is called the silent killer because it has no odor and it slowly overcomes those who are overexposed. Symptoms include: Headache, fatigue, shortness of breath, nausea and dizziness. Employees in the same room may or may not have all symptoms simultaneously. As with all field work, use the buddy system to keep each other safe.

5.7.2 Treatment of Carbon Monoxide Exposure

If you think you are experiencing any of the symptoms of CO poisoning, get fresh air immediately. Open windows and doors for more ventilation, turn off any combustion equipment, and leave the building. See medical treatment. You could lose consciousness and die if you do nothing. It is also important to contact a doctor immediately for a proper diagnosis. Tell your doctor that you suspect CO poisoning is causing your problems. Prompt medical attention is important if you are experiencing any symptoms of CO poisoning when you are operating fuel-burning devices.

If there are any changes or modifications to the work or site conditions that present additional hazards not covered by this addendum or the site-specific HASP, the PM and the HSO shall be notified.

5.8 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, fire ants, scorpions, and other pests.

5.8.1 Tick Borne Diseases

Lyme Disease – The disease commonly occurs in summer and is transmitted by the bite of infected ticks.

Erlichiosis – The disease also commonly occurs in summer and is transmitted by the bite of infected ticks.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

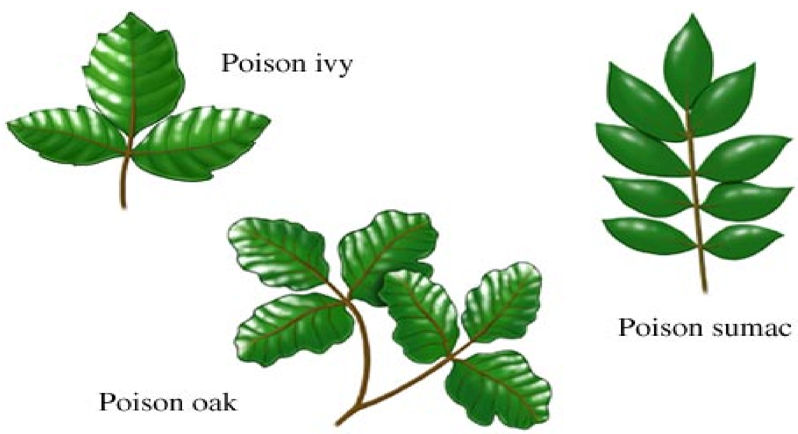
Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) – This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (*Rickettsia rickettsii*) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for 2 to 3 weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control – Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every 3 or 4 hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

5.8.2 Poisonous Plants

Poisonous plants may be present in the work area. Personnel should be alerted to its presence, and instructed on methods to prevent exposure.



Poison oak has leaves that look like oak leaves, usually with three leaflets but sometimes up to seven leaflets per leaf group. It grows as a vine or a shrub. Poison oak is more common in the western United States, but it is also found in the eastern United States and, rarely, in the Midwest.

Poison sumac has seven to 13 leaflets per leaf stem. All plant parts are poisonous. The leaves have smooth edges and pointed tips. Poison sumac grows as a shrub or small tree. The lack of leaflet glands, “wings” between the leaflets, and teeth on the leaves, in addition to this species' red stems supporting the leaflets and leaves, help to distinguish this plant from similar-looking nonpoisonous species, such as other sumacs and tree-of-heaven. It is found in wooded, swampy areas and in wet, wooded areas in the northern United States.

Poison Oak

Poison Sumac

Control – The main control for poisonous plants is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance.

Contact with poisonous plants is very easy to treat ***if*** you identified your contact with the irritating plant within a few hours of the incident. The urushiol oil present in both plants chemically bonds with the proteins in your skin about 30 minutes after contact. Seventy-five percent of the population is affected by contact with urushiol, although immunity to urushiol today does not assure immunity tomorrow, and vice versa. Rash symptoms can appear within a few hours but can take 2 to 5 days to appear. The rash starts as a red, annoyingly itchy area that starts to swell. The area then gets inflamed and will get covered in clusters of tiny pimples, the pimple eventually merge and turn into blisters. The fluid in the blisters turns yellow, dries up, and becomes crusty. Left completely untreated, this cycle can last as short as 5 days and in severe cases as long as 5 to 6 weeks.

If you come in contact with a poisonous plant, or an animal exposed to any of these, or tools, gear, or clothing exposed to any of these, you should wash off with hot water (not so hot that it burns) and strong soap as soon as possible. If you can get washed up in the first 6 hours before the first symptoms appear, you have a good chance of avoiding an outbreak, and an even better chance of minimizing the effects if you do have one.

5.8.3 Snakes

The possibility of encountering snakes exists, specifically for personnel working in wooded/vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances by enzymatic actions. Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control – To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes and the need to avoid actions that might cause encounters. To lower the risk of being bitten:

- Leave snakes alone. Many people are bitten because they try to kill a snake or get a closer look at it.

- Stay out of tall grass unless you wear thick leather boots. Snake gators may be needed for work in swampy and/or heavily wooded areas.

- Keep hands and feet out of areas you can not see. Do not pick things up from tall grass, vegetated areas or debris piles without first disturbing the area with a long implement.

- Observe tree limbs and branches before making contact since many snakes live in trees.

If a snake bite occurs, a quick attempt should be made to identify the snake via size and markings. The victim must be transported to the nearest hospital immediately. First aid consists of washing the area around the wound to remove any unabsorbed venom, immobilizing the wounded area and placing it lower than the heart. If medical attention cannot be given within 30 minutes, a band may be applied directly above the wound to restrict the movement of venom – do not apply a tourniquet. The band should be loose enough for a finger to pass beneath it, and should not restrict the flow of blood to the area.

5.8.4 Spiders

Personnel may encounter spiders during work activities.

Two spiders are of concern: the black widow and the brown recluse. Both prefer dark sheltered areas, such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately 1-inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widow's body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the southern United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful and the bite site ulcerates and takes many weeks to heal completely.

Control – To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel need to avoid actions that may result in encounters, such as turning over logs and placing hands in dark places, such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible; first aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

5.8.5 Mosquitoes

Personnel may be exposed to mosquitoes during work activities.

Typical exposure to mosquitoes does not present a significant hazard. However, if West Nile virus is prevalent in the area exposure to this virus is increased. West Nile virus results in flu-like symptoms and can be serious if not treated or in immune-compromised individuals. There have been confirmed cases of West Nile virus in the Northeast.

Control – To minimize the threat of mosquito bites, all personnel working outside must be aware of the potential for encountering mosquitoes and implement the basic precautions listed below:

- Avoid working at dawn or dusk when mosquitoes are most active.
- Prevent accumulation of standing water at the work-site.
- Apply an insect repellent that contains DEET to exposed skin and to clothing.
- Wear light colored clothes, preferably with long-sleeves and full-length pants.
- Do not touch any dead birds or animals that you encounter.

If dead birds are detected near the site, report to the local County Health Department. If flu-like symptoms are present, contact your doctor or the HSO for more information.

5.8.6 Other Stinging Insects

Thousands of other insects are capable of stinging and producing a negative reaction in humans. These insects include bees, wasps, hornets, centipedes, beetles, and flies. Some insects are more likely than others to cause allergic or toxic reactions.

- A bee leaves the stinger behind and then dies after stinging. Africanized honeybees, the so-called killer bees, are more aggressive than common honeybees and often attack together in great numbers.

- Wasps, including hornets and yellow jackets, can sting over and over. Yellow jackets cause the greatest number of allergic reactions.

Bites and stings are more serious if you develop one or more of the following conditions after an insect bite or sting. These conditions include:

- a toxic reaction
- a large skin reaction
- signs of a skin infection
- a severe allergic reaction (anaphylaxis)

Anaphylaxis is a sudden, severe allergic reaction. In anaphylactic shock, the most severe form of anaphylaxis, blood pressure drops severely; water rapidly leaves the blood stream, causing severe swelling; and bronchial tissues swell dramatically. This causes the person to choke and collapse. Anaphylactic shock is fatal if not treated immediately.

Anaphylaxis occurs usually within minutes of exposure to the allergen and almost always within 2 hours. The most severe cases may be fatal just 10 minutes after exposure. If administered in time, an injection of epinephrine (adrenaline) may reverse the condition by quickly constricting blood vessels, increasing the heart rate, stopping the swelling around the face and throat, and relaxing smooth muscles in the lungs. Because anaphylaxis can progress so quickly, the first signs of reaction should be taken seriously. Do not wait to see how serious the reaction may become; call for emergency help immediately.

It is recommended that all site workers with known allergies to insects, such as allergies to bees, inform coworkers of their condition and carry the appropriate medication with them into the field.

Control – To minimize the risk of insect bites, long-sleeves and full-length pants should be worn if possible. All personnel working in vegetated areas and/or around debris piles and monitoring wells must be aware of the potential for encountering stinging insects. Personnel should avoid actions that may result in encounters, such as turning over logs and placing hands in dark places, such as behind equipment or in corners of equipment sheds or enclosures. First aid for all stings and bites consists of washing the area around the wound to remove any unabsorbed venom and applying ice packs to minimize swelling.

5.9 Noise

For information and control measures for ARCADIS personnel, see section III.L-Noise in the ARCADIS Employee Field H&S Handbook. Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the greater the intensity and the longer the duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site. As a general rule, sound levels that cause speech interference at normal conversation distance probably require the use of hearing protection.

Control – All personnel must wear hearing protection with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a coworker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 7.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

5.10 Spill Control

All personnel must take every precaution to minimize the potential for spills during site operations. All on-site personnel shall immediately report any discharge, no matter how small, to the HSS.

Spill control equipment and materials will be located on site at locations that present the potential for discharge. All sorbent materials used for the cleanup of spills will be containerized and labeled appropriately. In the event of a spill, the HSS will follow the provisions in Section 11, Emergency Action Plan (EAP), to contain and control released materials and to prevent their spread to off-site areas.

5.11 Sanitation

Site sanitation will be maintained according to OSHA requirements. Also see section III.F-General Housekeeping, Personal Hygiene and Field Sanitation requirements in the ARCADIS Employee Field H&S Handbook.

5.11.1 Break Area

Breaks must be taken in the SZ, away from the active work area after site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the SZ.

5.11.2 Potable Water

The following rules apply to all field operations:

- An adequate supply of potable water will be provided at each project site. Potable water must be kept away from hazardous materials or media, and contaminated clothing or equipment.

- Portable containers used to dispense drinking water must be capable of being tightly closed, and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.

- Containers used for drinking water must be clearly marked and shall not be used for any other purpose.

- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing used cups is required.

5.11.3 Sanitary Facilities

Access to facilities for washing before eating, drinking, or smoking, or alternate methods, such as waterless hand-cleaner and paper towels will be provided.

5.11.4 Lavatory

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided for projects with greater than 5-day duration.

This requirement does not apply to mobile crews or to normally unattended site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

5.12 Emergency Equipment

Adequate emergency equipment for the activities being conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on site prior to the commencement of project activities. Personnel will be provided with access to emergency equipment, including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of and 29 CFR 1910.38 and 1926.156

- Industrial first-aid kits of adequate size for the number of personnel on site

- Emergency eyewash and/or shower if required by operations being conducted on site

5.13 Lockout/Tagout Procedures

Only fully qualified and trained personnel will perform maintenance procedures. Before maintenance begins, lockout/tagout procedures per General Industry Safety Orders, Electrical Safety Orders 23.20.4 and OSHA 29 CFR 1910.147 as well as the ARCADIS Control of Hazardous Energy Procedure (ACHSSI004) and Section III (Z, AA) of the ARCADIS H&S Field Handbook will be followed.

Lockout is the placement of a device that uses a positive means, such as lock, to hold an energy or material-isolating device, such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system shall be used. Tagout is the placement of a warning tag on an energy- or material-isolating device indicating that the equipment controls may not be operated until the tag is removed by the personnel who attached the tag.

5.14 Electrical Safety

Electricity may pose a particular hazard to site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it. Also see the requirements in the ARCADIS procedure http://apex/HS/Documents/ARC%20HSFS006_Electrical_Safety_Rev4_25Feb2008.pdf.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code, the National Electrical Code, or USCG regulations.
- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double-insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload.
- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension cord outlets must be equipped with ground-fault circuit interrupters.
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- Extension cords or cables must be inspected prior to each use and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.

- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

5.15 Lifting Safety

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.

- The hands and the object should be free of dirt or grease that could prevent a firm grip.

- Gloves must be used and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.

- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.

- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.

- The load should be kept as low as possible, close to the body with the knees bent.

- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.

- A worker should not carry a load that he or she cannot see around or over.

- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees, and the back is straight as the object is lowered.

5.16 Ladder Safety

When portable ladders are used for access to an upper landing surface, the ladder side rails shall extend at least 3 feet above the upper landing surface to which the ladder is used to gain access, or, when such an extension is not possible because of the ladder’s length, then the ladder shall be secured at its top to a rigid support that will not deflect. A grasping device, such as a grab rail, shall be provided to assist employees in mounting and dismounting the ladder. In no case shall the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

- Ladders shall be maintained free of oil, grease, and other slipping hazards.

- Ladders shall not be loaded beyond the maximum intended load for which they were built or beyond their manufacturer’s rated capacity.

- Ladders shall be used only for the purpose for which they were designed.

- Non self-supporting ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

- Wood job-made ladders with spliced side rails shall be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.

- Fixed ladders shall be used at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder.

- Ladders shall be used only on stable and level surfaces unless secured to prevent accidental displacement.

- Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.

- Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways shall be secured to prevent accidental displacement, or a barricade shall be used to keep the activities or traffic away from the ladder.

- The area around the top and bottom of ladders shall be kept clear.

- The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment.

- Ladders shall not be moved, shifted, or extended while occupied.

- Ladders shall have non-conductive side rails if they are used where the employee or the ladder could contact exposed energized electrical equipment.

- The top, top step, or the step labeled that it or any step above it should not be used as a step.

- Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.

- Ladders shall be inspected by the HSS for visible defects on a daily basis and after any occurrence that could affect their safe use.

- Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components shall either be immediately marked in a manner that readily identifies them as defective, or be tagged with “Do Not Use” or similar language, and shall be withdrawn from service.

- Fixed ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; or corroded components; shall be withdrawn from service.

- Ladder repairs shall restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.

- Single-rail ladders shall not be used.

- When ascending or descending a ladder, the user shall face the ladder.

- Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.

- An employee shall not climb any ladder while carrying items with the hands.

  Note: See also Section III.J-Ladders (Portable/Fixed) in the ARCADIS Field H&S Handbook.

5.17 Confined Space Entry

Confined space entry by ARCADIS employees is not anticipated on this site. In the event that the scope of work changes and confined space entry by ARCADIS employees is required, a HASP addendum will be prepared to address confined space entry requirements. The addendum will reference the ARCADIS Confined Space Procedure (ARCHSSF003) and Section III.Y-Confined Spaces in the ARCADIS Field H&S Handbook. In the case, confined space entry would be performed only by trained personnel using established procedures defined by ARCADIS and included in the appropriate HASP addendum. Confined space entry is considered a high risk work activity.

5.18 Chemical Hazards

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to site COCs. Concentrations of airborne COCs during site tasks may be measurable, and will require air monitoring during intrusive operations. Air monitoring requirements for site tasks are outlined in Section 7.1.

Site COCs may include: Benzene, Benzo(a)pyrene, Coal Tar Pitch Volatiles, Cyanides, Ethylbenzene, Toluene and Xylene.

The potential for inhalation of site COCs is moderate. The potential for dermal contact with soil containing site COCs during soil sampling operations is moderate. Chemical Hazard information showing the chemical, physical, and toxicological properties of major site COCs is presented below. Material Safety Data Sheets (MSDS) for the COCs are included in Appendix F.

Air monitoring will be conducted as outlined in this HASP to collect exposure data for chemicals of concern (COC) or for chemicals brought onsite for use. The table below lists the properties of chemicals that will be encountered at the site.

Chemical Hazard Information

Chemical Name	IP (eV)	Odor Threshold (ppm)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm)	IDLH (NIOSH) (ppm)	STEL (ppm)	Source TLV/PEL
Benzene [71-43-2]	9.24	34-119	Inhalation, Skin Absorption, Ingestion, Skin and /or eye contact/ Irritated eyes, nose, and respiratory system, giddiness; headache, nausea; staggered gait; fatigue; anorexia, lassitude; dermatitis; bone marrow depression -carcinogenic	1 ppm (0.5 ppm) NIC-0.1 skin 0.1 ppm	Ca (1,000 ppm)* *OSHA 29 CFR 1910.1028	2.5 ppm	PEL TVL REL
Benzo(a)pyrene [50-32-8]	ND	ND	Inhalation, Ingestion /Irritated eyes, skin, respiratory tract; skin irritation with burning sensation, rash, and redness, dermatitis.	0.2 mg/m^3 0.1 mg/m^3			PEL TLV REL
Coal Tar Pitch Volatiles [65996-93-2]	ND	ND	Inhalation, Skin and/or eye contact/dermatitis, bronchitis, [potential occupational carcinogen]	0.2 mg/m^3* 0.1 mg/m^3** *benzene soluble fraction **cyclohexane soluble fraction	Ca [80 mg/m^3]		PEL TLV REL
Cyanides: calcium, potassium and sodium [592-01-8; 151-5—8; 143-33-9]	NA	ND	Inhalation, Skin Absorption, Ingestion, Skin and /or eye contact/asphyxiation and death can occur; weakness, headache, and confusion; nausea and vomiting; increased respiratory rate; slow respiratory gasping; irritated eyes and skin	5 mg/m^3 5 mg/m^3 (skin)	50 mg/m^3	C5 mg/m3* C5 mg/m3 *10 min	PEL TLV REL
Ethyl benzene [100-41-4]	8.76	0.09-0.6	Inhalation, Ingestion, Skin and /or eye contact/ Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	100 ppm 100 ppm 100 ppm	2,000 ppm	125 ppm 125 ppm 125 ppm	PEL TLV REL
Toluene [108-88-3]	8.82	0.16-37	Inhalation, Skin Absorption, Ingestion, Skin and /or eye contact/Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	100 ppm 50 ppm (skin) 100 ppm	2,000 ppm	150 ppm 150 ppm	PEL TLV REL

Chemical Name	IP (eV)	Odor Threshold (ppm)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm)	IDLH (NIOSH) (ppm)	STEL (ppm)	Source TLV/PEL
Xylene (o-, m-, and p-isomers) [1330-20-7; 95-47-6; 108-38-3; 106-42-3]	8.56 8.56 8.44	1.1-20	Inhalation, Skin Absorption, Ingestion, Skin and /or eye contact/irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	100 ppm 100 ppm 100 ppm	1,000 ppm	150 ppm 150 ppm 150 ppm	PEL TLV REL

[1] The TLV (Threshold Limit Value) from the American Conference of Governmental Industrial Hygienists (ACGIH) is listed unless the PEL (Permissible Exposure Limit), designated by OSHA, is lower.

* The TLV (Threshold Limit Value) from the American Conference of Governmental Industrial Hygienists is listed unless the PEL (Permissible Exposure Limit), designated by OSHA, is lower.

Material Safety Data Sheets (MSDS) for the chemicals listed above are available in Appendix F.

See Section 7.1 for information on air monitoring requirements.

6. Tailgate Meetings

Tailgate safety briefings will be conducted at least twice daily, at the beginning of the work day, again after lunch or as tasks/hazards change. Each tailgate safety briefing will be documented on the form included in Appendix G.

7. Personal Exposure Monitoring and Respiratory Protection

Personal and area exposure monitoring will be documented on the Real Time Exposure Monitoring Data Form provided in Appendix G. All monitoring equipment will be maintained and calibrated in accordance with manufacturer's recommendations. All pertinent monitoring data will be logged on the form and maintained on site for the duration of project activities. Calibration of all monitoring equipment will be conducted daily and logged on the same form.

7.1 Air Monitoring

Air monitoring will be conducted to evaluate airborne levels of COCs. The monitoring results will dictate work procedures and the selection of PPE for ARCADIS employees and ARCADIS visitors only. The monitoring devices to be used, at a minimum, are an MIE PDR 1000 particulate monitor (or equivalent) and a combination lower explosive limit/oxygen/ hydrogen sulfide/carbon monoxide/photoionization detector (PID) with a 10.6 or 11.7 eV lamp. The RAE Systems MultiRae is an example of this type of instrument. Compound-specific detector tubes will be used to measure the airborne concentrations of Benzene if the PID readings exceed 0.75 ppm sustained for 15 minutes.

Drager tube measuring ranges are as follows:

Benzene 0.5 – 10 ppm

Monitoring for organic vapors and particulates will be conducted in the exclusion zone during all ground intrusive activities. Monitoring data will be recorded on the Air Monitoring Form (Attachment G).

Monitoring will be conducted continuously with the multi meter at the point of drilling in areas where flammable vapors or gases are suspected. All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10 percent of the LEL at the point of drilling or any location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level.

Monitoring will be conducted in the breathing zone every 15 minutes using the Data RAM to evaluate the level of airborne particulates.

At a minimum, ARCADIS will implement dust control procedures whenever total dust levels exceed 0.75 mg/m^3. The following dust suppression measures will be utilized during sampling and soil boring activities:

- Minimize the area of exposed soil.
- Apply water to soil during sampling/boring activities.
- Apply water to dry soil based on site observation and real-time air monitoring.

7.2 Noise Monitoring

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

7.3 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed HS documentation/forms must be reviewed by the HSS and maintained by the SS.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer’s procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer’s procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the HSS must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The HSS will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

7.4 Action Levels

Table 7-1 presents airborne contaminant action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the site. The action levels provided below are for air concentrations that are measured in the area(s) where employees are working. Level C operations should be avoided via engineering controls whenever possible.

Table 7-1. Airborne Contaminant Action Levels

Parameter	Reading in Breathing Zone (BZ)	Action
Total Organic Vapors[1]	0 ppm to < 0.5 ppm	Normal operations; record breathing zone monitoring measurements every hour
	> 0.5 ppm to 5 ppm	Increase recording frequency to at least every 15 minutes and use benzene Drager tube to screen for the presence of benzene
	> 5 ppm to ≤50 ppm	Upgrade to level C PPE, continue screening for benzene
	> 50 ppm	Stop work; evacuate work area, investigate cause of reading, reduce through engineering controls, contact HSO
Benzene (as determined by colorimetric tube)	> 1 ppm to 10 ppm	Upgrade to Level C PPE
	>10 ppm	Stop work; evacuate confined spaces/work area, investigate cause of reading; contact HSO
Total Particulate	0 to 0.100 mg/m^3 above background	Normal operations
	> 0.100 mg/m^3 above background	Initiate wetting of work area to control dust; upgrade to Level C if dust control measures do not control dust within 15 minutes, monitor downwind impacts.
	> 0.15 mg/m^3 in breathing zone or at downwind perimeter of work area	Stop work; investigate cause of reading; contact PM and HSO
Oxygen	< 19.5 %	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
	> 19.5% to < 23.5 %	Normal operations
	≥ 23.5 %	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Carbon Monoxide	0 ppm to ≤20 ppm	Normal operations
	> 20 ppm	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO

Parameter	Reading in Breathing Zone (BZ)	Action
Hydrogen Sulfide	0 ppm to ≤ 5 ppm > 5 ppm	Normal operations Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Flammable Vapors (LEL)	< 10% LEL > 10% LEL	Normal operations Stop work; ventilate area; investigate source of vapors

Note:
[1] If action levels in the worker breathing zone are exceeded for organic vapors or particulates, air monitoring will be required at various onsite/perimeter locations to determine appropriate response activities that are protective of personnel onsite who are not directly involved with the investigation, personnel at adjacent commercial sites, and the surrounding community, as detailed in Section 7.5 of this HASP.

7.5 Onsite Monitoring Plan and Response Activities

Soil borings will be completed at onsite locations as part of the field investigation activities. These activities have the potential to generate organic vapors and particulates. As mentioned above, air monitoring will be conducted in the worker breathing zone to determine the level of protection required for personnel observing completion of soil borings. If action levels as promulgated in the New York State Community Air Monitoring Program (CAMP) in the worker breathing zone are exceeded for organic vapors or particulates (Table 7-1 above), air monitoring will be required at various onsite/perimeter locations to determine appropriate response activities that are protective of personnel onsite who are not directly involved with the investigation, personnel at adjacent commercial sites, and the surrounding community. If action levels for the remaining monitoring parameters listed in Table 7-1 are exceeded, work will stop, the HSO will be contacted, and perimeter monitoring will be performed. Additional monitoring (and appropriate response activities) to be implemented if the total organic vapor and particulate levels in the worker breathing zone exceed action levels as discussed below.

Total Organic Vapors

If the sustained level of total organic vapors in the worker breathing zone exceeds 1 ppm above background, then the level of total organic vapors will be manually recorded at the downwind perimeter of the work area (i.e., exclusion zone) at 15 minute intervals. If the sustained level of total organic vapors at the downwind perimeter of the work area exceeds 1 ppm above background, then work activities will be halted and additional downwind monitoring will be performed. Efforts will be undertaken to mitigate the source of organic vapors. The exclusion zone will be enlarged, if necessary, to mitigate the potential for people who are not involved with the investigation from being exposed to organic vapor levels exceeding 1 ppm above background.

During the investigation, it is possible that the downwind perimeter of the work area will coincide with the site perimeter. If, at any time, the sustained level of total organic vapors adjacent to the downwind site perimeter reaches 5 ppm above background, then the level of total organic vapors adjacent to the nearest downwind occupied building or property from the work zone will be monitored. If after 30 minutes, the total organic vapor level adjacent to the nearest occupied building or property has not subsided below 1 ppm above background, then the HSS will inform the local emergency response contacts [in addition to project managers from National Grid, the NYSDEC, the New York State Department of Health (NYSDOH), and ARCADIS] listed in Appendix H and persons who may be exposed will be notified to evacuate occupied buildings or properties. These persons will not be permitted to return to the properties until after the level of total organic vapors on the properties subsides to below 1 ppm above background.

Particulates

If the level of particulates in the worker breathing zone exceeds 0.1 mg/m^3 above background for 1 minute, then the level of particulates will be manually recorded at the downwind perimeter of the work area at 15 minute intervals. If the level of particulates at the downwind perimeter of the work area is 0.15 mg/m^3 or greater, then work activities will cease and dust suppression techniques must be employed to maintain particulate levels below 0.15 mg/m^3. In addition, the exclusion zone will be enlarged if necessary to keep the public from being exposed to particulate levels greater than 0.15 mg/m^3.

7.6 Odor Control

If any odor complaints are received from members of the surrounding community and are related to the field investigation activities described herein, then the potentially odor-causing activity will be suspended, subsurface openings will be covered, and onsite personnel (in consultation with National Grid and ARCADIS project managers) will evaluate an alternative course of action

8. Medical Surveillance

Medical surveillance requirements for the project are provided on the Project Manager/Task Manager H&S Stewardship Checklist & Project Hazard Analysis Worksheet (Appendix B). All medical surveillance requirements as indicated on the worksheet must be completed and site personnel medically cleared before being permitted on the project site.

9. General Site Access and Control

The SSO will coordinate access and control security at the work site. As the work dictates, the SSO will establish a work area perimeter. The size of the perimeter will be based on the daily task activities and will be discussed with all project personnel during the tailgate meeting and then documented on the tailgate meeting form. Control zones for Level C or above will be demarcated by either visual or physical devices and will be monitored for effectiveness by the SSO.

Only authorized personnel will be allowed beyond the perimeter. Other site workers and visitors to the site should be kept out of the work site. If visitors need access to the site, the SSO will escort the visitor at all times. All visitors will log in and out with the SSO. The visitor log sheet is included in Appendix G.

No employees will be allowed to enter areas designated as high-voltage unless accompanied by an authorized National Grid employee. Only National Grid employees trained and authorized to work around high voltage equipment will be allowed to work in close proximity of high voltage line or to de-energize equipment.

10. Decontamination Control Zones and Procedures

Part of required reading for this HASP includes reviewing the Field H&S Handbook, Section III-G Site Security, Work Zones and Decontamination for HAZWOPER site zones. The decontamination procedures outlined in the Field H&S Handbook are provided for typical Level D and Level C ensembles.

The zones for Level C and above will be designated by traffic cones, barricades, signs, caution tape, or other means effective in identifying the different areas. The SSO will establish control boundaries for the exclusion zone, contamination reduction zone, and the support zone. The zones will be identified by the SSO during tailgate meetings and documented on the meeting form. Entrance and exit to the exclusion zone will only be through controlled access points established for each work area.

Level B or Level A decontamination procedures are detailed in the below:

Level A/B Decontamination Steps

Level A Decontamination Steps		Level B Decontamination Steps	
EZ-1	Segregated Equipment Drop	EZ-1	Segregated Equipment Drop
EZ-2	Boot Cover and Glove Wash	EZ-2	Boot Cover and Glove Wash
EZ-3	Boot Cover and Glove Rinse	EZ-3	Boot Cover and Glove Rinse
EZ-4	Tape Removal	EZ-4	Tape Removal
EZ-5	Boot Cover Removal	EZ-5	Boot Cover Removal
EZ-6	Outer Glove Removal	EZ-6	Outer Glove Removal
CRZ-7	Suit/Safety Boot Wash	CRZ-7	Outer Glove Removal
CRZ-8	Suit/Safety Boot Rinse	CRZ-8	Suit/SCBA/Boot/Glove Rinse
CRZ-9	Encapsulated Suit Partial Removal/Tank Change	CRZ-9	Tank Change
CRZ-9a	Redress-return to EZ	CRZ-9a	Redress-return to EZ
CRZ-10	Safety Boot Removal	CRZ-10	Safety Boot Removal
CRZ-11	Encapsulated Suit Removal	CRZ-11	SCBA Removal
CRZ-12	SCBA Removal	CRZ-12	Splash Suit Removal
CRZ-13	Inner Glove Wash	CRZ-13	Inner Glove Wash
CRZ-14	Inner Glove Rinse	CRZ-14	Inner Glove Rinse
CRZ-15	Face-piece Removal	CRZ-15	Face-piece Removal
CRZ-16	Inner Glove Removal	CRZ-16	Inner Glove Removal
CRZ-17	Inner Clothing Removal	CRZ-17	Inner Clothing Removal
SZ-18	Field Wash	SZ-18	Field Wash
SZ-19	Redress	SZ-19	Redress

EZ-Exclusion Zone CRZ-Contamination Reduction Zone SZ-Support Zone

11. Emergency Action Plan (EAP)

In the event that an injury, over-exposure or spill has occurred, an EAP will be implemented. Appendix H provides the EAP and notifications for the project. All employees working on this project must be shown the location and proper use of all emergency equipment prior to beginning work on the project.

12. Department of Transportation (DOT) Dangerous Goods Shipping Requirements

ARCADIS has policies in place for transporting small quantities of hazardous materials and for offering for shipping via ground or air. These policies are designed to meet the applicable requirements. As such, only ARCADIS staff that have been trained in the proper methods to prepare and ship hazardous materials are authorized to do so. Tasks associated with the packaging, labeling, marking, and preparation of hazardous materials for shipping or transport must have all appropriate and applicable training.

12.1 Materials of Trade (MOT)

DOT allows for a small amount of hazardous materials that are used in or an inherent part of our work to be transported in company vehicles. This includes things like gasoline, paint, small compressed gas cylinders, calibration gas, etc. To transport these:

- Staff will complete Materials of Trade training.
- Vehicles used in transportation to and from off-site work locations will be in conformance with ARCADIS vehicle safety procedures.

Hazardous materials will be transported as described above as a result of the activities covered in this HASP. Site personnel who transport materials mentioned above will complete the Hazardous Materials Transportation Form included in Appendix G.

12.2 Department of Transportation

Staff who collect, prepare, package, mark, label, complete shipping declarations, offer shipments to a transporter, directly transport or are engaged in other activities associated with the transportation of Hazardous Materials (referred to as Dangerous Goods in Canada and by the International Air Transport Association [IATA]) will have appropriate and applicable training. DOT requires all individuals who participate in hazmat shipping including activities such as completing the paperwork (but not signing it), filling a container with a hazardous material (including filling a drum with drill cuttings or purge water), marking, labeling, and packaging the hazardous material, etc., have awareness level training on the DOT requirements. DOT requires additional job function training for those who conduct specific activities including:

- Staff who have to sign shipping papers or manifests, are listed as the 24-hour emergency contacts on shipping and have the responsibility for identifying, classifying, packaging, marking, and labeling HazMat packages, and/or are directing or overseeing others who do these tasks will become certified through the completion of additional training.

- The above training allows the offering employee to ship only by ground. If the shipment is to be offered for air transport, additional training is required.

Shipments as described above will be made as a result of the activities covered in this HASP. Site personnel shipping hazardous materials will complete the Hazardous Materials Shipment Form included in Appendix G.

13. Loss Prevention System^{TM} (LPS^{TM}) and Loss Prevention Observations (LPOs)

As part of any project, no matter how simple or complex, LPOs should be conducted when practical and when able to integrate into normal business activities. LPOs should be scheduled based on the risk of the tasks being performed, and should be conducted for different tasks and at different times. Completion of LPOs should be documented on the tailgate meeting form.

The following table outlines the LPO plan for the project:

Identified Task for LPO	Schedule Date	Observer Name	Observee Name	Feedback Supervisor Name
GW Sampling	6/25/2009	Dan Zuck	J. Oliver	

14. Subcontractors

A copy of this HASP is to be provided to all subcontractors prior to the start of work so that the subcontractor is informed of the hazards at the site. While the ARCADIS HASP will be the minimum health and safety requirements for the work completed by ARCADIS and its subcontractors, each subcontractor, in coordination with ARCADIS health and safety personnel, is expected to perform its operations in accordance with its own HASP, policies and procedures unique to the subcontractor's work to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to ARCADIS for review prior to the start of on-site activities.

In the event that the subcontractor's procedures/requirements conflict with requirements specified in this HASP, the more stringent guidance will be adopted after discussion and agreement between the subcontractor and ARCADIS project health and safety personnel. Hazards not listed in this HASP, but known to the subcontractor or known to be associated with the subcontractor's services, must be identified and addressed to the ARCADIS project or task manager and SSO prior to beginning work operations.

If the subcontractor prefers to adopt this HASP, the **"Subcontractor Acknowledgement Memo" must be signed and dated by the subcontractor's management and placed in the project file.** Once the signed memo is received by the project manager, an electronic version of our HASP can be submitted to the subcontractor to use as their own. Subcontractors working at the site will need to have this plan with them, and will also need to sign the Subcontractor HASP acceptance and acknowledgement forms located at the beginning of this document. Subcontractors are responsible for the H&S of their employees at all times, and have the authority to halt work if unsafe conditions arise.

The Project/Task Manager and SSO (or authorized representative) has the authority to halt the subcontractor's operations and to remove the subcontractor or subcontractor's employee(s) from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

15. Project Personnel HASP Certification

All site project personnel will sign the certification signature page provided at the beginning of this HASP.

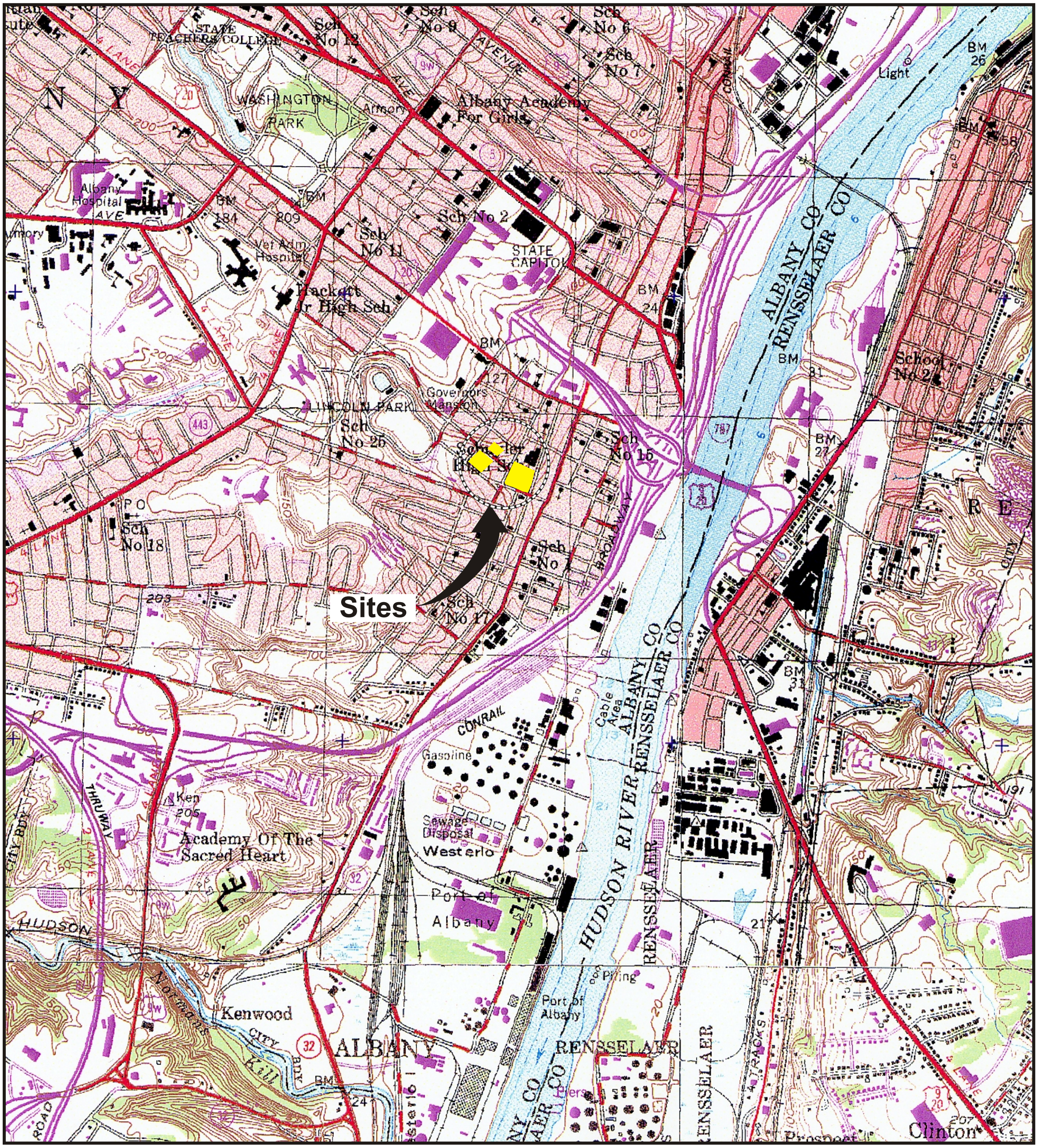
15.1 Project Hazard Analysis

The Project Hazard Analysis below identifies the hazards that are anticipated to be encountered by the project team.

Physical Hazards Present: ☐ None	☒ Heat ☒ Cold ☒ Noise ☒ Walking/working surfaces (includes slip/trip/fall & floor/wall openings) ☐ Visible Dust ☐ LASER ☒ Other: Pinch points	☐ Holes/Pits ☐ Ionizing radiation ☐ Non-ionizing radiation ☒ Electricity ☒ Severe Weather ☐ Poor lighting ☒ Overhead Hazards ☐ Other:
Environmental/Equipment Hazards Present: ☐ None	☒ Heavy machinery ☐ Trenching/excavation ☐ Docks – marine operations ☐ Docks – loading ☐ Diving operations ☒ Drilling ☐ Forklifts ☐ Water operations work ☐ Elevated heights (includes fall protection) ☒ Overhead/Underground utilities ☐ Confined spaces ☒ Power tools/Hand Tools	☐ Cranes/Hoists/Rigging ☐ Ladders ☐ Scaffolding ☐ Man lifts ☐ Welding ☒ Gas cylinders ☒ Roadway work ☐ Railroad work ☐ Energized equipment (LO/TO) ☐ Pressurized equipment (LO/TO) ☒ Drums and containers ☐ Other:
Biological Hazards Present: ☐ None	☐ Animal/human fluids or blood ☐ Animal/human tissue(s) ☐ Poisonous/irritating plants ☐ Other:	☐ Contaminated needles ☐ Live bacterial cultures ☒ Insects/rodents/snakes ☐ Other:
Ergonomic Hazards Present: ☐ None	☐ Repetitive motion ☒ Awkward position ☒ Heavy lifting ☒ Frequent lifting ☐ Other:	☐ Limited movement ☐ Forceful exertions ☒ Vibration ☐ Other: ☐ Other:
Personal Safety/Security: ☐ None	☒ Personal safety ☐ Security issue ☐ Project site in isolated area ☐ Employees working alone ☒ Other: unsecure area after 5:00 PM	☒ Employees working early/late ☐ Potentially dangerous wildlife ☐ Guard or stray dogs in area ☐ No/limited cell phone service ☐ Other:
Driving Safety ☐ None	☒ Driving early/late ☒ Driving long trip ☐ Driving off-road	☒ City driving ☐ Pulling trailer ☐ Other:

Chemical Hazards: ☐ None	☐ Flammable/Combustible ☒ Compressed gas ☐ Explosive ☐ Organic peroxide ☐ Oxidizer ☐ Water reactive ☐ Unstable reactivity ☒ Dust/Fumes/ Particulates	☐ Corrosive ☐ Toxic ☐ Highly toxic ☐ Irritant ☐ Sensitizer ☒ Carcinogen ☐ Mutagen ☐ Other:
Training Required: ☐ None	☒ 40-hour HAZWOPER ☐ 24-hour HAZWOPER ☒ HAZWOPER site supervisor ☐ OSHA 30-hour Construction ☐ OSHA 10-hour Construction ☐ PPE ☐ Respiratory protection ☐ Chemical hygiene ☐ Hazard communication ☐ Hazardous waste ☒ First-aid/CPR ☐ DOT/IATA hazmat transportation ☐ Diving ☐ Other:	☐ Bloodborne pathogens ☐ Confined space ☐ Lockout/tagout ☒ Electricity ☐ Fire extinguishers ☐ Fall protection ☐ Noise exposure ☐ Forklifts ☐ Asbestos ☐ Lead ☐ Cadmium ☐ SPCC ☐ Radiation safety ☐ Client specific
Medical Screening	☒ Medical Surveillance Exam (HAZWOPER) ☐ Client required drug and/or alcohol testing	☐ Blood and/or urine screening for other hazardous substances

FIGURES



REFERENCE: Figure obtained from 3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS portions of Albany, Troy South, Delmar, and East Greenbush Quadrangle.

2000' 0 2000'

Approximate Scale: 1" = 2000'

Area Location

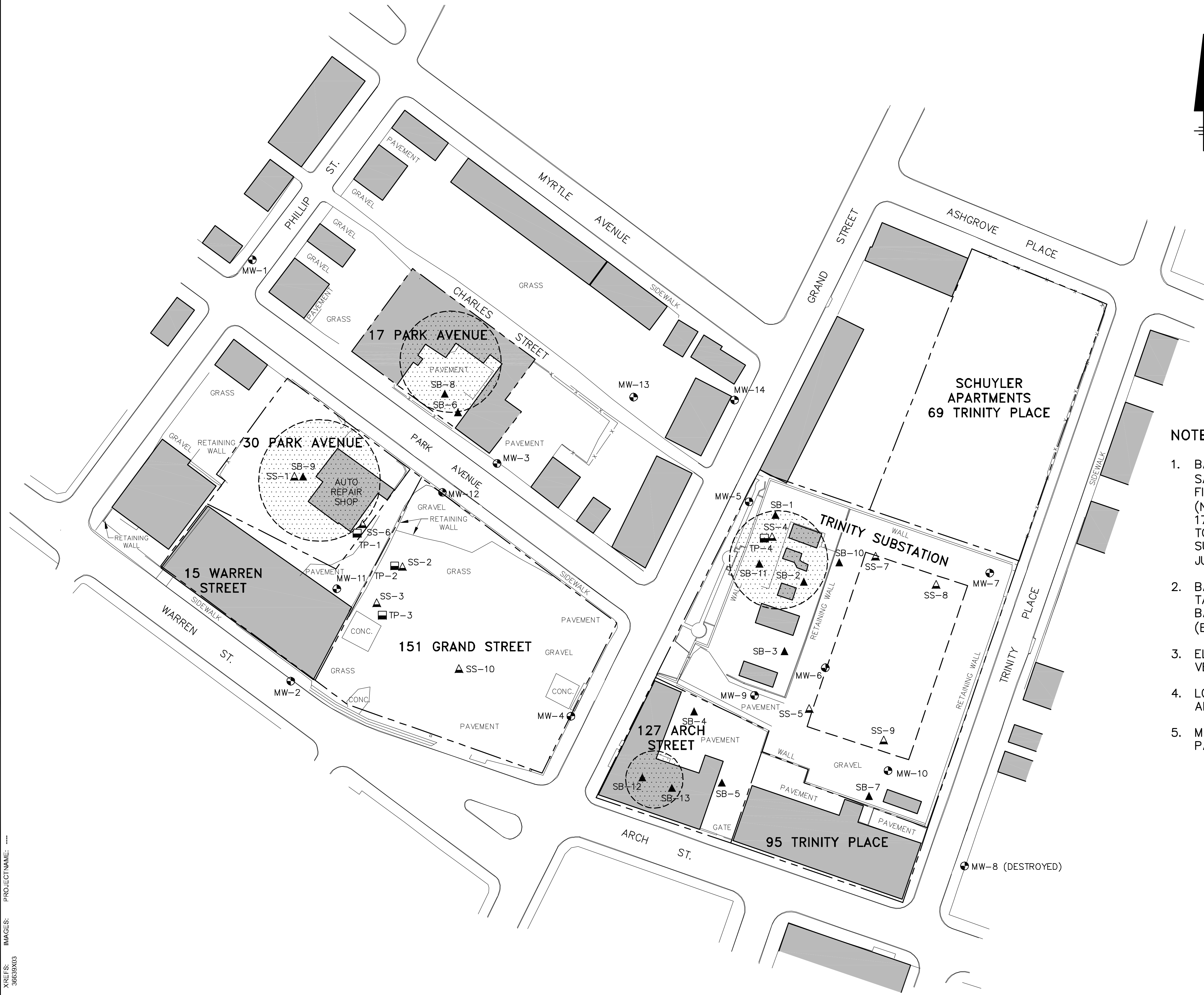
NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SUPPLEMENTAL INVESTIGATION

SITE LOCATION MAP

ARCADIS

FIGURE
1

04/21/09 SYRACUSE, NY-ENV/CAD-DHOWES
B0036639/0000/00010/CDR/36639N01.CDR



LEGEND:

MW-7 MONITORING WELL LOCATION

SS-8 SURFACE SOIL SAMPLE LOCATION

SB-10 SOIL BORING LOCATION

TP-4 TEST PIT LOCATION

BUILDING/STRUCTURE

FENCE

APPROXIMATE PROPERTY LINE

APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NATIONAL GRID DURING JULY/AUGUST 2004 AND DECEMBER 2005.
2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE)
3. ELEVATIONS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
4. LOCATIONS OF SOIL BORINGS SB-10, SB-11, SB-12 AND SB-13 ARE APPROXIMATE.
5. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.

0 100' 200'

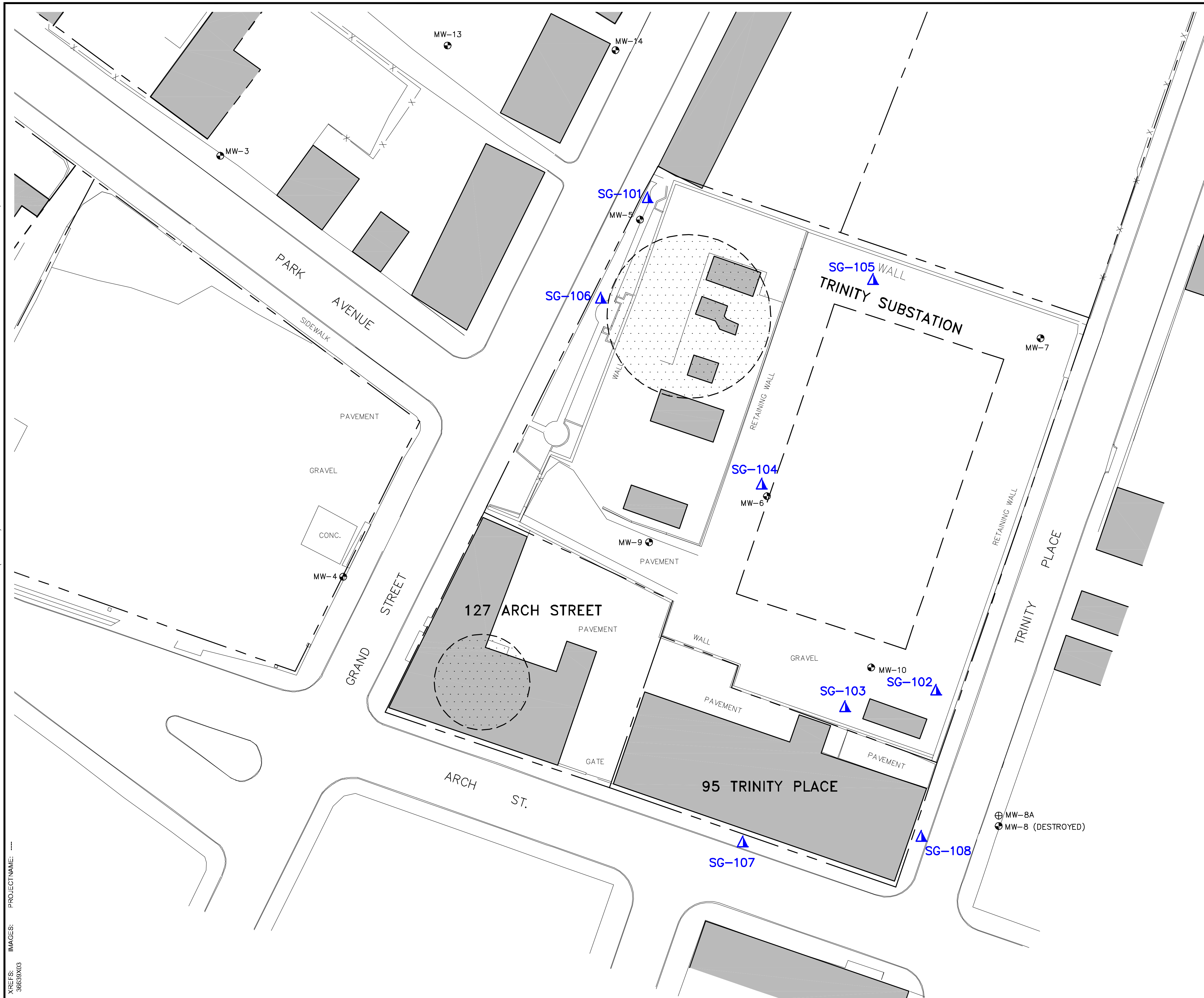
GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SITE CHARACTERIZATION REPORT

SITE MAP SHOWING 2004 - 2007 MONITORING LOCATIONS

ARCADIS

FIGURE
2



LEGEND:

MW-8A ⊕ PROPOSED MONITORING WELL MW-8 REPLACEMENT LOCATION

MW-7 MONITORING WELL LOCATION

SG-101 PROPOSED SOIL-GAS SAMPLING LOCATION

BUILDING/STRUCTURE

—x—x— FENCE

— — — APPROXIMATE PROPERTY LINE

APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES

NOTES:

1. BASE MAP (INCLUDING BUILDING, UTILITY, AND SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-5259-E, DATED SEPTEMBER 17, 2004, ENTITLED TRINITY SUBSTATION TOPOGRAPHIC MAP. THE MAP IS BASED ON A SURVEY CONDUCTED BY NATIONAL GRID DURING JULY/AUGUST 2004 AND DECEMBER 2005.

2. BASE MAP ALSO DEVELOPED FROM CITY OF ALBANY TAX MAPS NO. 76.14, 76.49, AND 76.57. THE MAP IS BASED ON NEW YORK STATE PLANE NAD 1983 (EASTERN ZONE) AND THE VERTICAL DATUM USED WAS NGVD 88.

3. MONITORING WELL MW-8 WAS DESTROYED BY A THIRD PARTY.

0 60' 120'

GRAPHIC SCALE

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
SUPPLEMENTAL INVESTIGATION

PROPOSED SOIL GAS AND REPLACEMENT GROUNDWATER MONITORING WELL LOCATIONS

ARCADIS

FIGURE
3

ARCADIS

APPENDICES

ARCADIS

Appendix A

HASP Addendum Pages and Log Table

ARCADIS

Addendum Page

This form should be completed for new tasks associated with the project. The project manager and/or task manager should revise the Project Hazard Analysis Worksheet with the new task information and attach to this addendum sheet. JSAs should be developed for any new tasks and attached as well.

Review the addendum with all site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the site copy, and log in the Addendum Log Table A-1 on the next page.

Addendum Number: ____________________ Project Number: ____________________

Date of Changed Conditions: ____________________ Date of Addendum: ____________________

Description of Change that Results in Modifications to HASP:

Signed: ______________________________
Project Manager

Signed: ______________________________
Site Safety Officer

Signed: ______________________________
H&S Plan Writer

Signed: ______________________________
H&S Plan Reviewer

Addendum Log Table

Addendums are to be added to every copy of the HASP, and logged on Table A-1 to verify that all copies of the HASP are current:

Table A-1 Addendum Log Table

Addendum Number	Date of Addendum	Reason for Addendum	Person Completing Addendum
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Make additional copies of this form as necessary.

ARCADIS

Appendix B

Project Hazard Analysis Worksheet

Hazard Assessment and Risk Control Process for ARCADIS

Hazard Types+

BIO - Biological
BLD - Building-Related Hazards
CH - Chemical
ERG - Ergonomic
PH - Physical
PS - Personal Safety and Security
TR - Transportation of people

These match the categories of hazards on the PM/TM/PIC H&S Stewardship Checklist.

Potential Control Processes and Methods***

1 - TRACK
2 - JSAs
3 - H&S plans
4 - Health and Safety Procedures (HSP)
5 - Hazard Control Sheets
6 - Tailgate safety meetings
7 - Awareness training
8 - Specialized training
9 - Client training
10 - Contingency/Emergency planning
11 - Engineering controls
12 - Administrative controls (including scheduling, job rotation, etc.)
13 - Personal Protective Equipment
14 - Specialized equipment (i.e., air monitoring, fall protection, ventilation)
15 - Housekeeping
16 - Inspections
17 - Other - consult H&S and job experts

FHSHB - Field Health and Safety Handbook

Risk Assessment Matrix

Consequences Ratings*		Likelihood Ratings** A	B	C	D	E
People	**Property**	Never heard of in the world	Heard of incident in industry	Incident has occurred in ARCADIS Global	Happens several times a year in ARCADIS OpCo	Happens several times a year at ARCADIS Worksite
0 - No health effect	0 - No damage	Low	Low	Low	Low	Low
1 - Slight health effect	1 - Slight damage	Low	Low	Low	Low	Low
2 - Minor health effect	2 - Minor damage	Low	Low	Low	Medium	Medium
3 - Major health effect	3 - Local damage	Low	Low	Medium	Medium	High
4 - PTD or 1 fatality	4 - Major damage	Low	Medium	Medium	High	High
5 - Multiple fatalities	5 - Extensive damage	Medium	Medium	High	High	High

Note: Consequence Ratings should be based on the current controls the OpCo has in place.

Organizational Groups ++

ENV - Environmental Division Management
SER - Site Evaluation and Remediation (includes LFR Engineering, Civil, and Geosciences and Qualitative Services)
CES - Construction Environmental Services (includes LFR Remediation)
GMAS - Global Management Advisory Services (includes LFR Compliance, IH, ESA, H&S, and Sustainable Business practices)
SED - Sediments
P&P - Environmental Planning and Permitting (includes LFR Ecological Services)
RAAS - Risk Assessment Advisory Services
EN TKI - Environemntal Technical Knowledge and Innovation
EN CD - Environmental Client Development
IN - Infrastructure Division Management
PM/CM - Project Management/Construction Management (includes LFR litigation services)
IN AD - Infrastructure Alternative Delivery
WR - Water Resources (includes LFR Geotechnical)
LR - Land Resources
TR - Transportation
IN TKI - Infrastructure Technical Knowledge and Innovation
IN CD - Infrastructure Client Development
CORP - Corporate Services (includes CEO, Acctg, Comm, Legal, HR, Fed, Real Estate, IT, Integration, and H&S)

			Potential Consequences (Rating)*		Likelihood**						Organizational Groups That May Encounter This Hazard++																	
Hazard Type+	Hazard and Hazardous Activities	Description of Potential Impact / Risks	Health (People)	Property	Health (People)	Property	Overall Risk (Comments attached to cells explain Medium and High Risk rankings)	Specific Control Procedures Currently Implemented to Control the Hazard (use codes*** or brief description)	Other Potential Control Processes and Methods that can be implemented***	Related Document(s) Reference	EN Division	SER	CES	GMAS	SED	P&P	RAAS	EN TKI	EN CD	IN Division	PMCM Division	IN AD	WR	LR	TR	IN TKI	IN CD	CORP
BIO	Insects - ticks, bees, wasps, spiders, black flies, mosquitos - bites or stings	Allergic reactions, West Nile virus, lyme disease and Rocky Mountain Spotted fever	2	0	E	A	Medium	7, 11, 13	1, 3, 6, 7, 11, 13, 15	FHSHB		x	x	x	x	x	x				x	x	x	x	x			
BLD	Electrical hazards from equipment - electric shock or fire	Burns, property damage	2	2	C	B	Low	3, 7, 10	1, 4, 7, 8, 11, 13, 15, 16	ARC HSFS006	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BLD	Emergencies (i.e., fire, tornado, hurricane, earthquake)	Physical injury, property damage	5	5	B	B	Medium	7	1, 4, 7, 10, 11, 12, 15, 16	ARC HSMS008	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BLD	Parking lots - traffic	Injury from accident; property damage	2	2	B	C	Low	16	1, 7, 12, 16	ARC HSGE024	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BLD	Poor housekeeping - creating slips, trips, falls; fire hazard, or difficulty in evacuating building	Personal injury from falling to floor, and property damage	1	2	C	B	Low	11	1, 4, 7, 10, 15, 16	FHSHB	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
CH	Carcinogens - inhalation or skin contact with	Respiratory irritation, skin irritation, long term exposure can lead to cancer of various parts of body dependent on chemical	1	0	C	A	Low	3, 11	1, 3, 6, 7, 8, 9, 11, 13, 14	ARC HSIH003 ARC HSIH009		x	x	x	x	x							x					
CH	Contaminated soil, water and sediment - inhalation or skin contact	Various acute and chronic effects depending on contaminant and concentrations	1	0	C	A	Low	3, 11, 13	1, 3, 6, 7, 11, 13, 14	FHSHB		x	x		x	x	x											
ERG	Awkward positioning	Back and extremity and/or joint injury; muscle soreness	3	0	D	A	Medium	7	1, 2, 3, 6, 7, 11, 12, 14	FHSHB		x	x	x	x	x							x	x	x			
ERG	Lifting - frequent	Back and upper extremity injury; dropped objects on body part; damage from falling objects	3	1	D	C	Medium	7	1, 2, 3, 6, 7, 11, 12, 14	FHSHB		x	x		x	x					x		x	x	x			
ERG	Lifting - heavy	Back and upper extremity injury; dropped objects on body part; damage from falling objects	3	1	D	C	Medium	7	1, 2, 3, 6, 7, 11, 12, 14	FHSHB		x	x		x	x								x				
ERG	Repetitive motion	Back and extremity and/or joint injury; muscle soreness	3	0	D	A	Medium	7	1, 2, 3, 6, 7, 11, 12, 14	FHSHB		x	x		x	x								x				
PH	Drums and containers - failure causing release	Fire, explosion, respiratory distress from breathing released material, skin damage from exposure to released material	2	3	C	D	Medium	7, 11	1, 2, 3, 4, 6, 8, 10, 11, 13, 14, 15, 16	FHSHB		x	x	x	x	x							x					
PH	Hazardous energy - electrical	Electric shock or electrocution; fire	4	3	D	B	High	3, 8, 11, 12, 13, 14	1, 2, 3, 4, 6, 7, 8, 11, 13, 14, 15, 16, 17	ARC HSFS006		x	x	x	x	x					x		x	x				x
PH	Heavy equipment - working on ground in the vicinity of heavy equipment including drill rigs	Injury from being hit by something, getting caught in moving equipment; property damage if hit	4	2	C	C	Medium	3, 8, 16	1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 14, 16	FHSHB		x	x	x	x	x					x		x	x	x			
PH	Natural hazards (weather/geological) - cold	Frostbite, hypothermia, loss of dexterity,	2	1	C	B	Low	7, 13	1, 3, 4, 6, 7, 11, 12, 13, 14	FHSHB		x	x	x	x	x					x	x	x	x	x			
PH	Natural hazards (weather/geological) - heat	Heat related skin rashes, heat exhaustion, heat stroke leading to serious medical illness, increase fatigue leading to other injuries, or decreases judgment leading to other injuries.	2	1	C	A	Low	7	1,3, 4, 6, 7, 11, 12, 13, 14	FHSHB		x	x	x	x	x					x	x	x	x	x			
PH	Natural hazards (weather/geological) - lightning	Skin burns, death, fire and other property damage	4	2	B	C	Medium	7, 10	1, 3, 6, 10, 12, 14	FHSHB		x	x	x	x	x					x	x	x	x	x			
PH	Natural hazards (weather/geological) - rain - poor visibility, slippery roads and walking surfaces, slippery controls, etc.	Property damage, indirectly can lead to personal injury	4	3	D	C	High	7, 10	1, 3, 4, 6, 7, 11, 12, 13, 14	FHSHB	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PH	Natural hazards (weather/geological) - snow and ice - poor visibility, slippery roads and walking surfaces, slippery controls, etc.	Property damage, indirectly can lead to personal injury	4	3	D	C	High	7, 10	1, 3, 6, 7, 11, 12, 13, 14, 16	FHSHB	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PH	Natural hazards (weather/geological) - sun	Sunburn, glare,	2	0	C	A	Low	7	1,3, 4, 6, 7, 11, 12, 13, 14	FHSHB		x	x	x	x	x					x	x	x	x	x			
PH	Noise - exposre to	Hearing loss - temporary or permanent; not being able to hear other hazards or emergency signals	1	0	B	A	Low	4, 11, 13	1, 3, 6, 7, 11, 12, 13, 14	ARC HSIH008		x	x	x	x	x					x	x	x	x	x			x
PH	Pinch points from moving parts including doors, closures, rotating devices, etc - getting a part of the body in a pinch point	Personal injury from crushing of body parts	2	1	E	B	Medium	7, 11, 13	1, 7, 11, 12, 13, 16	FHSHB		x	x	x	x	x							x	x				
PH	Poor housekeeping - creating slips, trips, falls; fire hazard, or difficulty in evacuating building	Personal injury from falling to floor, and property damage	2	1	D	C	Medium	16	1, 2, 3, 6, 7, 11, 12, 13, 15, 16	none	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PH	Roadside traffic	Personal injury from being struck by vehicle or flying objects produced from vehicle running over objects or flying off moving vehicles.	4	3	C	C	Medium	3, 8, 11	1, 2, 3, 4, 6, 7, 11, 12, 13, 14, 17	FHSHB		x	x			x					x	x	x	x	x			
PH	Tool usage - hand tools - hammers, screwdrivers, etc. - ergonomic stress, hitting body parts	Personal injury and property damage from misuse	2	1	C	C	Low	7, 11, 13	1, 2, 3, 4, 6, 7, 8, 11, 12, 13, 14, 16	FHSHB		x	x		x	x					x	x	x	x	x			
PH	Tool usage - small power tools - drills, saws, etc. - ergonomic stress, contacting body parts, noise	Personal injury and property damage from misuse	2	1	C	C	Low	7, 11, 13	1, 2, 3, 4, 6, 7, 8, 11, 12, 13, 14, 16	FHSHB		x	x	x	x	x					x	x	x	x	x			x
PH	Utilities - above ground - striking or contacting	Injury based on type of utility; fire, explosion, or electrocution; disruption of service	4	3	C	C	Medium	4, 8, 11	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 16	ARC HSFS019		x	x		x	x					x			x				
PH	Utilities - underground - striking or contacting	Injury based on type of utility; fire, explosion, or electrocution; disruption of service	4	4	C	D	High	4, 8, 11	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 16	ARC HSFS019		x	x		x	x								x				
PH	Vibration from equipment being used	Nerve damage to effected body parts	2	0	B	A	Low	3, 7, 11	1, 3. 6. 7, 11, 12, 13, 14	FHSHB		x	x	x	x	x								x				x
PH	Working in buildings in poor condition - structural collapse	Serious injury and property damage,	4	2	C	C	Medium	3, 7, 11, 16	1, 3, 4, 6, 7, 10, 11, 12, 14, 16, 17	FHSHB		x	x	x		x					x	x	x	x	x			
PS	Personal - fatigue	Lack of attention to hazards leading to injury and property damage	2	1	D	D	Medium	3, 6, 12	1, 7, 8, 12	FHSHB	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PS	Personal - fit for duty	Potential health effects from over-exerting or exacerbating existing condition	2	0	C	A	Low	17	1, 7, 8, 12	FHSHB	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PS	Personal - lack of experience, education, or knowledge	Lack of attention to hazards leading to injury and property damage	2	1	D	D	Low	17	1, 7, 8, 12	FHSHB		x	x	x	x	x	x				x	x	x	x	x			x
PS	Personal - personal hygiene - ingestion or contact with chemical hazard	Illness from exposure to contaminants, spread of hazardous materials	1	0	B	A	Low	3, 7, 12	1, 3, 7, 11, 12	FHSHB		x	x	x	x	x					x	x	x	x	x			x
PS	Personal - stress - peer or supervisor pressures	Lack of attention to hazards leading to injury and property damage	2	0	D	A	Low	7, 12	1, 7, 8, 12	FHSHB	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

			Potential Consequences (Rating)*		Likelihood**						Organizational Groups That May Encounter This Hazard++																	
Hazard Type+	Hazard and Hazardous Activities	Description of Potential Impact / Risks	Health (People)	Property	Health (People)	Property	Overall Risk (Comments attached to cells explain Medium and High Risk rankings)	Specific Control Procedures Currently Implemented to Control the Hazard (use codes*** or brief description)	Other Potential Control Processes and Methods that can be implemented***	Related Document(s) Reference	EN Division	SER	CES	GMAS	SED	P&P	RAAS	EN TKI	EN CD	IN Division	PMCM Division	IN AD	WR	LR	TR	IN TKI	IN CD	CORP
PS	Personal - stress - working long hours	Lack of attention to hazards leading to injury and property damage	2	0	D	A	Low	7, 12	1, 7, 8, 12	none	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PS	Working at night - Slips, trips and falls; running into something, fatigue, personal security	Personal injury	2	2	C	C	Low	3, 11, 12	1, 3, 4, 6, 7, 11, 12, 14,	FHSHB		x	x	x	x	x					x	x		x				
PS	Working in dangerous areas (personal security and safety)	Personal injury due to assault, property damage or property is stolen,	3	2	D	C	Medium	7, 10, 12	1, 3, 4, 6, 7, 10, 12, 17	FHSHB		x	x	x	x	x					x	x	x	x	x			
TR	Motor vehicle operation - fatigue or lack of alertness from driving early or late in the day	Personal injury from accident; property damage from accident	4	3	D	E	High	7, 12	1, 2, 4, 6, 8, 11, 12, 13, 14, 16	ARC HSGE024	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
TR	Motor vehicle operation - larger vehicles - pick-up trucks, vans, etc.	Personal injury from accident; property damage from accident	4	2	D	E	High	8	1, 2, 4, 6, 8, 11, 12, 13, 14, 16	ARC HSGE024		x	x		x	x					x	x		x				
TR	Motor vehicle operation - roadway and traffice hazards of driving motor vehicles	Personal injury from accident; property damage from accident	4	2	C	E	Medium	8	1, 2, 4, 6, 8, 11, 12, 13, 14, 16	ARC HSGE024	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
TR	Motor vehicle operation - roadway hazards of driving in inclement natural hazards (weather/geological) (snow, ice, rain, etc).	Personal injury or death from accident, property damage from accident	4	3	D	D	High	8	1, 4, 8, 11, 12, 16	ARC HSGE024	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

ARCADIS

Appendix C

JLAs

Job Loss Analysis

General

Client Name	NATIONAL GRID
JSA ID	359
Job Name	Environmental-Air knife/hydro knife
Task Description	Air Knife
Project Number	B00366390000
Project Name	ALBANY (GRAND STREET) MGP
PIC Name	NUSS, JAMES
Project Manager	JONES, MICHAEL
Status Name	(1) Initial
Creation Date	6/1/2009

User Roles

Role Name	Employee	Due Date	Completed	Approve	Supervisor	Active Employee	Comments	Comment Date
Created By	Jaimes Palomera, Luis Ricardo	6/22/2009			Powlin, Scott	True		
Reviewer	Korik, Andrew				Mccune, William	True		

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Check and clear proposed Air-Knife locations for the presence of underground and overhead utilities	1	Staff can be hit by vehicular traffic	Wear reflective traffic vest. Establish work zone with cones.	
		2	Underground utilities can be encountered	Follow ARCADIS policy on utility location	
		3	Working neat high voltage	Arcadis personnel will be accompanied by National Grid personnel at all times.	
2	Clear hole using the Air-Knife	1	Subsurface coul have material that may contain rocks/sharp objects. Flying debris could cause injury to eyes, face, arms and legs.	Stay back a minimum of five feet from the Air-Knife while in operation by the contractor. Wear safety glasses, leather gloves, hard hat.	
		2	Operation of the Air-Knife generates excessive noise	hearing protection is required when the equipment is in operation	
		3	Vacuum unit has large amount of suction	Do not put any part of your body near the end of the hose	
3	Barricade open holes or fill if they will be unattended	1	Holes can be difficult to see depending on their size, and site workers could twist their anckle or fall if they step on an open hole	Holes can be as large as 6-8 inches in diameter and as deep as 8 feet. heavy cones, covers, orange barrels or cones with caution tape should be used to protect the holes.	
		2	Open holes unattended	Do not leave open holes unguarded. If holes must be left unattended prior to drilling- fill with inert sand or clean cuttings.	
		3	Lifting hazards from carrying heavy cones or orange barrels.	Minimize number of cones lifted at one time. Use tam lift approach when practicable	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required

Supplies

Type	Supply	Description	Required

Job Loss Analysis

General

Client Name	NATIONAL GRID
JSA ID	373
Job Name	Environmental-Drum sampling/handling
Task Description	Drum handling
Project Number	B00366390000
Project Name	ALBANY (GRAND STREET) MGP
PIC Name	NUSS, JAMES
Project Manager	JONES, MICHAEL
Status Name	(1) Initial
Creation Date	6/2/2009

User Roles

Role Name	Employee	Due Date	Completed	Approve	Supervisor	Active Employee	Comments	Comment Date
Created By	Jaimes Palomera, Luis Ricardo	6/23/2009			Powlin, Scott	True		
Developer (Primary Contact)	Jaimes Palomera, Luis Ricardo	6/23/2009			Powlin, Scott	True		
Reviewer	Korik, Andrew				Mccune, William	True		

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Set up support zone	1	Lifting and pulling, backstrain	Pre-planning and recon procedures. Use appropriate tools to handle drums and team pulling aproach	
2	Lifting and pulling	1	Sharp edges on drum, leaage or spillage from drum	team lift, have containment set up if drum leak or spill.	
3	Lifting and spillage	1	Lifting	Team lift, safelty glasses/splash shield. Appropriate gloves.Chemical protective clothing. label drums and what the contens are.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	coveralls		Recommended
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)		Required
	insect repellant		Required
	sunscreen		Required

Job Loss Analysis

General

Client Name	NATIONAL GRID
JSA ID	345
Job Name	Environmental-Geophysical survey
Task Description	GPR Utility location
Project Number	B00366390000
Project Name	ALBANY (GRAND STREET) MGP
PIC Name	NUSS, JAMES
Project Manager	JONES, MICHAEL
Status Name	(2) Review
Creation Date	5/29/2009

User Roles

Role Name	Employee	Due Date	Completed	Approve	Supervisor	Active Employee	Comments	Comment Date
Created By	Jaimes Palomera, Luis Ricardo	6/1/2009	6/1/2009		Powlin, Scott	True		
Developer (Primary Contact)	Jaimes Palomera, Luis Ricardo	6/1/2009	6/1/2009		Powlin, Scott	True		
HASP Reviewer	Webster, Charles	6/15/2009			Lynch, Edward	True		
Reviewer	Korik, Andrew	6/15/2009			Mccune, William	True		

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Mobilization of equipment to survey area	1	Lifting hazards (heavy or bulky equipment)	Use TRACK to plan lifts and routes to work location. Use proper lifting techniques	
		2	Awkward body postions and twisiting	Plan activity to avoid twisting of body or awkward body positions. Use buddy system or job rotation to reduce exposure to conditions that can not be avoided	
		3	Trip and fall hazards from uneven ground or restricted view when carrying equipment	Break loads down to manageable size that does not obstruct view of ground. Plan route and use TRACK, wear footwear with good tread and ankle support, Use buddy system for large or bulky items when carrying.	
2	Performing survey	1	Working near high voltage	Arcadis personnel will be accompanied by National Grid personnel al all times.	
		2	Slips trips and falls on wet, uneven or steep sloped surfaces	See step one controls.	
		3	Scrapes or cuts to hands, arms or legs from equipment or vegetation in area.	Wear leather or other suitabler gloves when perofroming survey, wear long pants, wear heavy long sleeve shirt if arm hazard exists.	
		4	Ergonomic injury form improper or prolonged use of carried devices that are long or bulky.	Use job rotation to reduce potential for injury.	
3	Demobilization and clean up	2	Pinch hazards to fingers from equipment cases	Identify hazard and avoid, pack equipment properly where not wires or cables protrude from case requiring fingers to push into case when closing.	
		3	Lifting hazards from demobilizing equipment from work area	See step one controls.	
		4	Slip, trip and falls carrying equipment that obstructs view or on wet or uneven surfaces.	See step one controls.	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	boots	supportive with good tread	Required
Hand Protection	work gloves (specify type)	leather	Required
Head Protection	hard hat		Recommended

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	first aid kit		Required
Traffic Control	traffic cones		Required

Job Loss Analysis

General

Client Name	NATIONAL GRID
JSA ID	362
Job Name	Environmental-Groundwater Sampling and free product recovery
Task Description	Groundwater Sampling
Project Number	B00366390000
Project Name	ALBANY (GRAND STREET) MGP
PIC Name	NUSS, JAMES
Project Manager	JONES, MICHAEL
Status Name	(1) Initial
Creation Date	6/1/2009

User Roles

Role Name	Employee	Due Date	Completed	Approve	Supervisor	Active Employee	Comments	Comment Date
Created By	Jaimes Palomera, Luis Ricardo	6/22/2009			Powlin, Scott	True		
Developer (Primary Contact)	Jaimes Palomera, Luis Ricardo	6/22/2009			Powlin, Scott	True		
Reviewer	Korik, Andrew				Mccune, William	True		

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Stage at pre-determined sampling location and set up work zone and sampling equipment	1	personnel could be hit by vehicluar traffic.	Set-up cones and establish work area. Position vehicle so that field crew is protected from site traffic. Unload as close to work area as safely possible.	
		2	Sampling equipment, tools and monitoring well covers can cause tripping hazard	Keep equipment picked up and use TRACK to assess and changes	
		3	Working near high voltage	Arcadis personnel will be accompanied by National Grid personnel at all times.	

2	Open wells to equilibrate and gauge wells	1	When squatting down, personnel can be difficult to see by vehicular traffic.	Wear Class II traffic vest at all times. Use tall cones and the buddy system if practicable.	
		2	pinchpoints on well vault can pinch or lacerate fingers	Use correct tools to open well vault/cap. Wear leather gloves when removing well vault lids, and chemical protective gloves while guaging. Wear proper PPE including safety boots, knee pads and safety glasses.	
		3	Lifting sampling equipment can cause muscle strain	Unload as close to work area as safely possible; use proper lifting and reaching techniques and body positioning; don't carry more than you can handle, and get help moving heavy or awkward objects.	
		4	Pressure can build up inside well causing cap to release under pressure	Keep head away from well cap when removing. If pressure relief valves are on well use prior to opening well	
3	Begin Purging Well and Collecting Parameter Measurements	1	Electrical shock can occur when connecting/disconnecting pump from the battery.	Make sure equipment is turned off when connecting/disconnecting. Wear leather gloves. Use GFCIs when using powered tools and pumps. Do not use in the rain or run electrical cords through wet areas.	
		2	purge water can spill or leak from equipment	Stop purging activities immediately, stop leakage and block any drainage grate with sorbent pads. Call PM to notify them of any reportable spill.	
		3	Water spilling on the ground can cause muddy/slippery conditions	Be careful walking in work area when using plastic around well to protect from spillage	
		4	lacerations can occur when cutting materials such as plastic tubing	When cutting tubing, use tubing cutter. No open fixed blades should ever be used. When possible wear work gloves, leather type.	
		5	purge water can splash into eyes	Pour water slowly into buckets/drums to minimize splashing. Wear safety glasses	
4	Collect GW or Free Product Sample	1	Working with bailer rope can cause rope burns on hands.	Slowly raise and lower the rope or string for the bailer. Wear appropriate gloves for the task.	
		2	sample containers could break or leak preservative	Discard any broken sampleware or glass properly. Do not overtighten sample containers. Wear chemical protective gloves	
5	Recovery of Free Product from well	1	exposure to free product	Additional chemical protection may be necessary based on the type of product. Additionally, safety goggles, a faceshield, or respiratory protection may be required. Verify in the HASP.	
6	Staging of Well Purge water and/or Free Product	1	Muscle strains can occur when moving purge water or drums	If using buckets, do not fill buckets up to the top. Always keep lid on buckets when traveling or moving them to another location. Only half fill buckets so when dumping the buckets weigh less. See drum handling JLA for movement of drums.	Drum handling JLA

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)		Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
Traffic Control	traffic cones		Required

Job Loss Analysis

General

Client Name	NATIONAL GRID
JSA ID	370
Job Name	Environmental-Drilling, soil sampling, well installation
Task Description	Monitoring well installation
Project Number	B00366390000
Project Name	ALBANY (GRAND STREET) MGP
PIC Name	NUSS, JAMES
Project Manager	JONES, MICHAEL
Status Name	(1) Initial
Creation Date	6/2/2009

User Roles

Role Name	Employee	Due Date	Completed	Approve	Supervisor	Active Employee	Comments	Comment Date
Created By	Jaimes Palomera, Luis Ricardo	6/23/2009			Powlin, Scott	True		
Developer (Primary Contact)	Jaimes Palomera, Luis Ricardo	6/23/2009			Powlin, Scott	True		
Reviewer	Korik, Andrew				Mccune, William	True		

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Set up necessary traffic and public access controls	1	Struck by vehicle due to improper traffic controls	Use a buddy system for placing site control cones and/or signage. Position vehicle so that you are protected from moving traffic. Wear Class II traffic vest	
2	Utility Clearance	1	Potential to encounter underground or aboveground utilities while drilling	Complete utility clearance in accordance with the ARCADIS H&S procedure	ARCADIS H&S Procedure ARCHSFS019
3	General drill rig operation	1	Excessive noise is generated by rig operation.	When the engine is used at high RPMs or soil samples are being collected, use hearing protection.	

3	General drill rig operation	2	During drill rig operation, surfaces will become hot and cause burns if touched, and COCs in the soils more readily vaporize generating airborne contaminates.	Due to friction and lack of a drilling fluid, heat will be produced during this method. Mainly drill augers. Be careful handling split spoons. Wear proper work gloves. When soils and parts become heated, the COC could volatilize. Air monitoring should always be performed in accordance with the HASP.	
		3	Moving parts of the drilling rig can pull you in causing injury. Pinch points on the rig and auger connections can cause pinching or crushing of body parts.	Stay at least 5 feet away from moving parts of the drill rig. Know where the kill switch is, and have the drillers test it to verify that it is working. Do not wear loose clothing, and tie long hair back. Avoid wearing jewelry while drilling. Cone off the work area to keep general public away from the drilling rig	
		4	Dust and debris can cause eye injury and soil cuttings and/or water could contain COCs.	Wear safety glasses and stay as far away from actual drilling operation as practicable. Wear appropriate gloves to protect from COCs.	
		5	Drilling equipment laying on the ground (i.e. augers, split spoons, decon equipment, coolers, etc), create a tripping hazard. Water from decon buckets generate mud and cause a slipping hazard.	Keep equipment and trash picked up, and store away from the primary work area.	
		6	The raised derrick can strike overhead utilities, tree limbs or other elevated items	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
		7	Working near high voltage	Subcontractor and Arcadis personnel will be accompanied by National Grid personnel at all times.	
4	Mudd rotary drilling	1	The raised derrick can strike overhead utilities, tree limbs or other elevated items	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
		2	This technology uses fluid, which collects with sediments in large basin. Fluid can splash out and cause slipping/mud hazard. Liquid mixture can splash into your eyes.	Wear rubber boots if needed, and keep clear of muddy/wet area as much as practicable. If area becomes excessively muddy, consider mud spikes or covering the area with a material that improves traction. Wear safety glasses.	
5	Hollow stem auger drilling	1	All hazards in step 3 apply. Additionally,The raised derrick can strike overhead utilities, tree limbs or other elevated items	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
6	Air rotary drilling	1	this drilling method works with high air pressure and can generate flying debris that can strike your body or get debris in your eyes.	When the drill rig is being driven into media, it will produce flying debris. The flaps behind the drill rig should stay closed whenever possible to reduce the risk of flying debris. Safety glasses and hard hat should always be worn when the drill rig is operating. When penetrating asphalt protect surrounding cars that may be present to avoid debris damage to paint or winshields.	

6	Air rotary drilling	2	The raised derrick can strike overhead utilities, tree limbs or other elevated items	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
		3	When drilling through bedrock prior to groundwater dust can be produced from pulverization. Inhalation of dusts/powder can occur	Supplemental water should be used to manage dust creation and/or dust masks if necessary.	
7	Reverse rotary drilling	1	This method will use fresh water to pump out drill cuttings through the center of the casing. Water/sediment mixture is generated and could cause contact with impacted soils or groundwater	Ensure the pit construction can hold the amount of cuttings that are anticipated. Air monitoring should also be used of pit area	
		2	Fire hydrants are often used for water source. Hydrants deliver water at high pressure. Pressurized water can cause flying parts/debris and excessive slipping hazards.	Water usage from fire hydrants should be cleared with local muncipalities prior to use. Only persons that know how to use the hydrant should be performing this task. Ensure all connections are tight, and hose line is not run over to cut by traffic. Any leaks from the hydrant should be reported immediately.	
		3	Settling pit construction can cause tripping hazard from excavated soils, and plastic sheeting can cause slipping.	cone off the area to keep the general public/visitors away from the settling pit. Ensure proper sloping of excavation.	
		4	The raised derrick can strike overhead utilities, tree limbs or other elevated items	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
8	Rotosonic drilling	1	Fire hydrants are often used for water source. Hydrants deliver water at high pressure. Pressurized water can cause flying parts/debris and excessive slipping hazards.	Water usage from fire hydrants should be cleared with local muncipalities prior to use. Only persons that know how to use the hydrant should be performing this task. Ensure all connections are tight, and hose line is not run over to cut by traffic. Any leaks from the hydrant should be reported immediately	
		2	This method requires a lot of clearance. The drill head can turn 90 degrees to attach to the next drill flight or casing. This usually requires a large support truck to park directly behind the rig. As the drill head raises the new casing flight is angled down at the same time until it can be turned completely vertical.	Ensure sufficient overhead clearance.	

8	Rotosonic drilling	3	Heavy lifting of cores can cause muscle strain.	Always use 2 people to move core containers. Use caution moving core samples to layout area. Plan layout area to ensure adequate aisle space between core runs for logging. Keep back straight and use job rotation.	
		4	The rotosonic drill head can move very quickly up and down while working on a borehole. Moving parts can strike someone or catch body parts	The operator and helper must communicate and stay clear of the path of the drill head. The drill utilizes two large hydrualic clamps to continuously hold casings while load/unloading previous casings. Do not wear loose clothing.	
9	Direct push drilling	1	The drill rods will be handled by workers most of the time rather than the rig doing it, therefore pinch points can cause lacerations and crushing of fingers/body parts.	Keep a minimum of 5 feet away from drill rig operation and moving parts.	
		2	The direct push rigs are usually meant to fit in spaces where larger rig can't. Tight spaces can pin workers.	Do not put yourself between the rig and a fixed object. Use Spotters or a tape measure to ensure clearances in tight areas. Pre-plan equipment movement from one location to the next.	
		3	some direct push equipment is controlled by wireless devices. These controls can fail and equipment can strike workers or cause damage to property.	The drill rig should be used in a large open area to test wireless controls prior to moving to boring locations. The operator of the rig will test the kill switch with wireless remote prior to use. Operator will stay in range of rig while moving so that wireless signal will not be too weak and cause errors to the controls.	
		4	Sampling sleeves must be cut to obtain access to soil. Cutting can cause lacerations.	Preferably let the driller cut the sleeves open. Many drillers have holders for the sleeve to allow for stability when cutting. If we cut the sleeves, use a hook blade, change blade regularly, and cut away from the body.	
10	Rock Coring	1	flying debris can hit workers or cause debris to get in eyes.	Rock chips or overburden may become airborne from drilling method. Wear safety glasses and hard hat and remain at a safe distance from back of drill rig.	
		2	Heavy lifting of cores can cause muscle strain.	Always use 2 people to move core containers. Use caution moving core samples to layout area. Plan layout area to ensure adequate aisle space between core runs for logging. Keep back straight and use job rotation.	
11	Sample collection and processing	1	Injuries can result from pinch points on sampling equipment, and from breakage of sample containers.	Care should be taken when opening sampling equipment. Look at empty containers before picking them up, and do not over-tighten container caps. Use dividers to store containers in the cooler so they do not break.	Sample cooler handling JLA
		2	lifting heavy coolers can cause back injuries	Use two people to move heavy coolers. Use proper lifting techniques.	
12	Monitoring well installation	1	Same hazards as in Step 3 with general drill rig operation	See step 3	
		2	monitoring well construction materials can clutter the work area causing tripping hazards.	Well construction materials should be picked up during the well installation process.	

12	Monitoring well installation	3	Heavy lifting can cause muscle strains, and cutting open bags can cause lacerations.	Well construction materials are usually 50 lbs or greater. Team lift or use drill rig to hoist bags. Always use work gloves while cutting open bags.	
		4	Well pack material (i.e. sand, grout, bentonite) can become airborne and get in your eyes.	Wear safety glasses for protection from airborne sand and dust.	
		5	Cutting the top of the well to size can cause jagged/sharp edges on the top of the well casing.	Wear gloves when working with the top of the well casing, and file any sharp jagged edges that resulted from cutting to size.	
13	Soil cutting and purge water management	1	Moving full drums can cause back injury, or pinching/crushing injury.	Preferably have the drilling contractor move full drums with their equipment. If this is not practicable, use lift assist devices such as drum dollys, lift gates, etc. Employ proper lifting techniques, and perfrom TRACK to identify pinch/crush points. Wear leather work gloves, and clear all walking and work areas of debris prior to moving a drum.	Drum handling JLA

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)		Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	traffic vest--Class II or III		Required
Respiratory Protection	dust mask		Recommended

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
Traffic Control	traffic cones		Required

Job Loss Analysis

General

Client Name	NATIONAL GRID
JSA ID	382
Job Name	Environmental-Groundwater Sampling and free product recovery
Task Description	Soil vapor sampling
Project Number	B00366390000
Project Name	ALBANY (GRAND STREET) MGP
PIC Name	NUSS, JAMES
Project Manager	JONES, MICHAEL
Status Name	(1) Initial
Creation Date	6/3/2009

User Roles

Role Name	Employee	Due Date	Completed	Approve	Supervisor	Active Employee	Comments	Comment Date
Created By	Jaimes Palomera, Luis Ricardo	6/24/2009			Powlin, Scott	True		
Developer (Primary Contact)	Jaimes Palomera, Luis Ricardo	6/24/2009			Powlin, Scott	True		
Reviewer	Korik, Andrew				Mccune, William	True		

Job Steps

Job Step	Job Step Description		Potential Hazard	Critical Action	HSP Reference
1	Stage at pre-determined sampling location and set up work zone and sampling equipment	1	personnel could be hit by vehicular traffic.	Set-up cones and establish work area. Position vehicle so that field crew is protected from site traffic. Unload as close to work area as safely possible.	
		2	Sampling equipment, tools and monitoring well covers can cause tripping hazard	Keep equipment picked up and use TRACK to assess and changes	
2	Open wells to equilibrate	1	When squatting down, personnel can be difficult to see by vehicular traffic.	Wear Class II traffic vest if wells are located proximal to vehicular traffic. Use tall cones and the buddy system if practicable.	
		2	pinchpoints on well vault can pinch or lacerate fingers	Use correct tools to open well vault/cap. Wear leather gloves when removing well vault lids, and chemical protective gloves while guaging. Wear proper PPE including safety boots, knee pads and safety glasses.	
		3	Lifting sampling equipment can cause muscle strain	Unload as close to work area as safely possible; use proper lifting and reaching techniques and body positioning; don't carry more than you can handle, and get help moving heavy or awkward objects.	
		4	Pressure can build up inside well causing cap to release under pressure	Keep head away from well cap when removing. If pressure relief valves are on well use prior to opening well	
3	Begin Purging Well and set up for sampling	1	use of comppressed Hellium gas cylinder	risk of release of big amounts of gas or blow up lines or valves.	
		2	lacerations can occur when cutting materials such as plastic tubing	When cutting tubing, use tubing cutter. No open fixed blades should ever be used. When possible wear work gloves, leather type.	
4	Vapor sampling using canisters	1	handling of canisters	use proper equipment to loosen and tight connections, check the valves for appropriate sampling	

Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)		Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
Traffic Control	traffic cones		Required

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Appendix D

PPE Equipment List

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PPE CHECKLIST

R = Equipment required to be present on the site. **O** = Optional equipment. Subcontractors must have the same equipment listed here as a minimum.

Description (Put Specific Material or Type in Box)	Level Of Protection		
	D	**C**	**B**
Body			
Coveralls	R	R	R
Chemical Protective Suit (include type in cell, e.g., Tyvek, Saranex, PVC, etc.)	O	R	R
Splash Apron	O	O	O
Rain Suit	R	R	R
Traffic Safety Vest (reflective)	R	R	R
Head			
Hard Hat (if does not create other hazard)	R	R	R
Head Warmer (depends on temperature and weather conditions)	R	R	R
Eyes & Face			
Safety Glasses (incorporate sun protection as necessary)	R	R	R
Goggles (based on hazard)	O	O	O
Splash Guard (based on hazard)	O	O	O
Ears			
Ear Plugs	R	R	R
Ear Muffs	O	O	O
Hands and Arms			
Outer Chemical Resistant Gloves (specify the type of glove based on chemical hazard)	R - Nitrile	R	R
Inner Chemical Resistant Gloves (specify the type of glove based on chemical hazard)	O	R	R
Insulated Gloves	O	O	O
Work Gloves*	R- leather (cut resistant when opening cores)	R	R

Description (Put Specific Material or Type in Box)	Level Of Protection		
	D	C	B
Foot			
Safety Boots (steel toe and shank)	R	R	R
Rubber, Chemical Resistant Boots	O	R	R
Rubber Boots	O	O	O
Disposable Boot Covers	R	R	R
Respiratory Protection			
1/2 Mask APR			
Full Face APR		R	R
Dust Protection			
Powered APR			
SCBA			
Air Line			

PPE SELECTION MATRIX

Task	Level of Protection
Mobilization, Site SurveyGPR Survey	Level D
Borehole Clearance using air knife	Modified Level D/Level C
Soil boring installation and sampling	Modified Level D/Level C
Monitoring well installation and development	Modified Level D/Level C
Groundwater sampling	Modified Level D/Level C
Soil vapor sampling	Level D/Modified Level D
Decontamination	Modified Level D
Demobilization	Level D

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Appendix E

ARCADIS H&S Procedures

Utility Location

1. POLICY

It is the practice of ARCADIS and its affiliated companies to implement appropriate, reasonable and practical procedures within acceptable and customary industry practices to promote the health and safety of its employees, and avoid and mitigate exposure of risk in the performance of their work. In furtherance of this policy, ARCADIS promotes and encourages compliance by all employees with this policy and procedures relating to subsurface work and/or investigations (SWI) and working in the vicinity of above ground utilities.

- This procedure is followed by all responsible ARCADIS personnel. Such procedures are included in the project planning processes utilized by ARCADIS personnel.

- Project management procedural requirements are outlined in Section 5.2. All employees included in SWI and above ground utility work are familiar with these procedures.

- Contract Terms: In agreements for SWI with a client, prime contractor, or subcontractors, required terms (Exhibit 1) shall be included for the appropriate allocation of risk of damage to subsurface facilities. If such provisions cannot be agreed upon, the reasons are documented and other risk-management actions identified, such as limits of liability, additional physical investigations, additional lines of evidence of utility location, assignment of risk to subcontractors, etc.

- The policy of ARCADIS encourages and empowers all employees to take such action as they deem appropriate to assure compliance with this policy and procedures both in project planning and field site operations. Such authority is delegated to those on the project site to immediately stop any SWI work or work in the vicinity of above ground utilities where the employee believes that injury to persons or damage to property could occur. Such action is taken without regard to costs or schedule. Personnel should immediately notify their supervisor of any concerns they have when observing any SWI work or work in the vicinity of above ground utilities. In all agreements between ARCADIS and SWI subcontractors, (e.g., drilling subcontractors), provisions shall be included in the subcontract, work authorization or purchase order. These provisions (Exhibit 1) are found on the ARCADIS intranet at the Legal Department team site.

All ARCADIS personnel involved in SWI work or work in the vicinity of above ground utilities will be appropriately trained on this procedure and have the appropriate professional experience for oversight of or involvement in SWI work or work in the vicinity of above ground utilities. ARCADIS Corporate Health & Safety can answer further questions about this policy or the hazards associated with and the control procedure for work in the vicinity of subsurface or above ground utilities.

Again, to support the efforts of ensuring the health and safety of its employees and mitigating risk to ARCADIS, ARCADIS requires that these policies and procedures be followed and implemented at all levels of project management and field implementation.

2. PURPOSE AND SCOPE

2.1 Purpose

This procedure directs general safety procedures associated with the identification and management of above ground and subsurface utility locations on project sites.

2.2 Scope

2.2.1 **Management Requirements** - ARCADIS personnel managing or working on any project requiring SWI and requiring work in the vicinity of above ground utilities must incorporate this procedure into their project planning and field work activities to ensure that all reasonable means to identify utilities are implemented and that appropriate controls have been put in place to minimize or eliminate damage to these utilities and the hazards associated with these utilities. All applicable procedures described in this document must be completed prior to initiating intrusive field work or field work in the vicinity of above ground utilities, or the work cannot proceed.

2.2.2 **Project Management Requirements** - Where SWI are required to be performed by a subcontractor to ARCADIS under its subcontract, project management shall require the subcontractor to adequately incorporate SWI procedures described herein into the subcontractor's scope of work.

3. DEFINITIONS

Above Ground Utilities - For the purpose of this procedure, above ground utilities include, but are not limited to: any above ground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or other hazardous materials.

Subsurface Utilities - For the purposes of this procedure, subsurface utilities include, but are not limited to: any underground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or sanitary sewage; underground storage tanks; tunnels and cisterns; and septic tanks.

4. RESPONSIBILITIES

4.1 Project Manager Responsibilities

To prevent injury to employees, avoid disruption to utility services, and help eliminate damage to subsurface and above ground utilities, project managers have the responsibility for utility identification, location, and marking prior to initiating field activities. Most states, provinces, municipalities, and clients have rules, general statutes, or laws that specify the requirements of subsurface utility location prior to intrusive subsurface field activities (i.e., excavation, trenching, boring, and all forms of drilling operations, etc.). The project manager ensures that these laws are followed, and that the directives outlined in this procedure are met for every project involving SWI and work in the vicinity of above ground utilities.

In addition, if field activities are completed in the vicinity of above ground utilities, the project manager is responsible for working with the client to identify the nature of the utilities, and to determine what control processes need to be implemented to prevent damage to these utilities and to minimize any injury in the event there is damage.

4.2 Field Personnel Responsibilities

Field personnel conducting SWI activities and activities where above ground utilities are in the vicinity of the work have the responsibility to read, understand, and follow this procedure and complete the appropriate checklists during the on-site utility locate process. ARCADIS personnel assisting in the identification of underground utilities need to have previous related experience of a minimum of 1 year. Those implementing remote sensing technologies must complete training in those techniques and have 6 months experience operating and interpreting results.

If utilities cannot be located to eliminate any reasonable concern, field personnel can use their Stop Work authority until utility locations can be identified. Field personnel must review this procedure onsite with ARCADIS subcontractors, and ensure they follow the procedures detailed in this document. Any ARCADIS subcontractor not following these procedures will be asked to stop work, and the project manager contacted. Any diversion from this procedure by ARCADIS field personnel must be approved by the project manager with input from Corporate Health & Safety as necessary.

5. PROCEDURE

A flow chart/decision tree of the procedure is presented in Exhibit 2 of this document.

5.1 Lines of Evidence

The following three actions (lines of evidence) are required for the utility location process:

- Contact the State One Call
- Obtain a detailed site utility plan drawn to scale, preferably an “as-built” plan
- Conduct a detailed visual site inspection

In the event that one or more of the above lines of evidence cannot be conducted, or if the accuracy of utility location is questionable, a minimum of one additional line of evidence must be utilized as appropriate or suitable to the conditions. Examples of additional lines of evidence include but are not limited to:

- Private utility locating service
- Research of state, county or municipal utility records and maps including computer-drawn maps or geographical information systems (GIS)
- Contact with the utility provider to obtain their utility location records

- Hand augering or digging
- Hydro-knife
- Air-knife
- Radio Frequency Detector (RFD)
- Ground Penetrating Radar (GPR)
- Any other method that may give ample evidence of the presence or location of subgrade utilities

5.2 Project Management Procedural Requirements

Field activities are planned and designed to avoid contact with and damage to, and minimize interference with subsurface and above ground utilities in the vicinity of ARCADIS work activities. During the planning phase of a project the project manager will insure the appropriate allocation of utility location responsibilities and verify their completion. The utility location activities will implement the lines of evidence as defined in Section 5.1.

5.2.1 Communication and Coordination

The PM or their designated Task Manager:

- Communicates verbally and in writing the responsibilities for utility location with each party
- Provides the list to the site safety officer for inclusion in the site-specific health and safety plan (HASP);
- Communicates potential hazards to field staff prior to mobilization;
- Instructs field staff to be aware of and implement the procedures in the Section 5.1 of this procedure and utilize the appropriate utility location checklists.
- When practical, schedules a joint meeting between the public/private utility locators and field staff to oversee the subsurface utility locating and marking in the field.
- Communicates with and provides utility location documentation to the subcontractors to verify with them the utility locations and discusses methods to be used to protect those utilities.
- Understands the subcontractor's methods for utility location and documenting the process with a clear delineation of responsibilities for utility location.

In general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked.

NOTE: At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.2.2 Utility Request Notifications for Public Property

Prior to intrusive work on public property (i.e., right-of-ways, easements, etc.), notification of a public one-call service center is completed a minimum of 48-72 hours (states/localities requirements vary, so the PM is responsible for verifying this) prior to initiating field activities (excluding Saturdays, Sundays, and legal holidays). Specific state or local laws related to utility location are evaluated with respect to notification and liability in the event of utility damage. During the call, the responsible party:

- Provides accurate description of the location of all areas of the SWI;
- Documents the utility locate request to record the time and date of the call, the area to be marked, the list of utility companies and municipalities that the one call service center will notify;
- Records the associated ticket (or dig) number provided by the one call service center;
- Cross references the notification list provided by the one-call service center with the list of known or suspected utilities for the property; and
- Provides accurate contact (responsible party name and phone numbers) information for the one call service center so they can subsequently communicate potential questions and/or delays related to the utility location and marking.

After receiving a request, the one-call service center sends requests to participating utility operators who have utilities in the area of the intrusive field activities. Each underground utility operator dispatches their own locators to mark their facilities with paint or flags. The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities. It is important to note:

- Not all utility operators and municipalities participate in one call programs. In some instances, one-call programs provide a list of utility providers that participate, and a list of those that do not. The utility providers that do not participate are contacted individually so that they can mark their own lines, and this call is documented (date of call, person receiving call, date lines will be marked, etc.);

- Public utility locators are usually only required to mark utilities within the public spaces (i.e., right of ways) or at most up to a meter on private property; and

- Knowledge of existing or suspected, but unmarked utilities are documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities.

If a known or suspected subsurface utility does not participate in the state one-call program, and that provider has not been individually contacted prior to the start of SWI, then the field activities are postponed. If these utility providers are contacted and do not provide utility location services, then SWI are not performed until a private utility locating company is contracted and the locating tasks completed.

5.2.3 Nation-wide Utility Locate Call Number 811

State and local utility notification centers participate in a “Call before you Dig” number for public safety and to protect underground infrastructure. This national number is: **811**. The number is designed to help prevent professional excavators, drillers and homeowners from damaging underground utility lines, or causing an injury or service outage while digging/drilling. For more information about the 811 services, visit www.call811.com

The number 811 is an FCC designated national n-11 number. This quick and efficient one call service will notify the appropriate utilities, who participate in the one call program. **However,** callers must still verify who the one call service contacts, and then determine which utilities may need to be contacted directly (e.g. those utilities not participating in the one call service) by following the requirements outlined in this procedure.

5.3 Field Protocol

At no time do field activities that involve SWI or work in the vicinity of above ground utilities commence without the field staff having knowledge of the location of subsurface and above ground utilities. In addition, as stated above and in general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, all lines of evidence must be re-verified.

NOTE: At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.3.1 SWI and Subsurface Utilities

Prior to the start of intrusive activities, all utilities are located and measures instituted to avoid subsurface utility hazards. No SWI will be conducted within 30 inches of a line marking. If SWI must take place within 30 inches of the line marking, an additional line of evidence must be used that will ensure the avoidance of the line. An additional safety measure can include the use of lockout/tagout to render the utility controlled.

Prior to mobilizing to the site for SWI work, field staff reviews the task details with the project manager or their designated authorized TM. This may include but is not limited to review of boring logs, excavation permits, etc. Any special site or client requirements are also discussed. Prior to initiation of any intrusive activities, the utilities and structures checklist (Exhibit 3) is reviewed and completed. Generally, the following colors apply for different types of utilities/operations:

Red – Electric;
Yellow – Natural gas/oil;
Orange – Communication/cable television;
Blue – Water;
Green – Sewer;
Pink – Temporary survey marking;
White – Proposed excavation; and
Purple – Reclaimed water

In addition, the SWI subcontractor marks (i.e., paint, stakes, etc.) the location of their operations to ensure they fall within the area that has been investigated for utilities.

Once the checklist is completed and all utilities identified, any client/site specific utility location or other utility (subsurface or above ground utilities) protection procedures (i.e. such as hand digging to a specified depth, covering or shielding lines, etc.) is completed at each location where work will be completed. If a known or suspected public subsurface utility has not been marked or the markings are not clear, the state one-call number is contacted to determine if an “emergency” locate can be requested. If so, follow the procedures outlined by the locate service and contact the project manager. If it is a private utility that is not marked, the facility manager and/or the project manager should be contacted.

If unexpected conditions are encountered (refusal, debris, pea gravel, etc.) while completing the intrusive activity, all work is immediately halted. Note that subsurface utilities at many industrial facilities are often placed in conduits or concrete to prevent damage. If a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

5.3.2 Work in the Vicinity of Above Ground Utilities

If activities take place in the vicinity of an above ground utility, the utility line can be rendered controlled (i.e. through lockout/tagout procedures) or protected from damage (i.e. covering overhead power lines). The following table is used to develop acceptable work distances for work involving machinery with high extensions (backhoes, drilling rig masts, etc.) in the vicinity of overhead power lines:

Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI Standard B30.5-1994, 5-3.4.5

The distance may be lengthened if directed by the client or the electric company, and any specified distances are strictly followed. In addition, work involving machinery, vehicles or equipment that may come in contact with above ground utilities is not completed until those utilities are protected or control processes are in place to avoid damage to those utilities.

If an above ground utility is discovered that has not been previously identified prior to mobilizing to the field, the field staff notifies the project manager who requests the client to assist in the identification of the utility and the implementation of control procedures as appropriate. In addition, if a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

6. RECORDS

6.1 Utilities Location Records

All records (maps and documentation of communications) used to determine the location of utilities should be retained and kept in the project file.

7. APPROVALS AND HISTORY OF CHANGE

Approved By: Mija Coppola, Director H&S, Infrastructure and PM/CM Divisions

Mija A. Coppola

History of Change

Revision Date	Revision Number	Reason for change
13 December 2006	01	Original document
26 March 2007	02	Put in new company format
15 May 2007	03	Added nation-wide 811 number
6 September 2007	04	Changing over to new template format
22 February 2008	05	Changing over to new template format
13 January 2009	06	Define lines of evidence

Exhibit 1 - Contract Term Language

INSERT INTO ALL CLIENT CONTRACTS OR WORK ORDERS WHERE DRILLING, EXCAVATION, INTRUSIVE WORK IS TO BE PERFORMED.

Site Conditions: ARCADIS shall not be liable for: (i) damage or injury to any subterranean structures (including, but not limited to, utilities, mains, pipes, tanks, and telephone cables) or any existing subterranean conditions; or the consequences of such damage or injury, if (with respect to this clause (i)) such structures or conditions were unknown and were not identified or shown, or were incorrectly shown, in information or on plans furnished to or obtained by ARCADIS in connection with the Services; (ii) concealed conditions encountered in the performance of the Services; (iii) concealed or unknown conditions in an existing structure at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iv) unknown physical conditions below the surface of the ground that differ materially from those ordinarily encountered and are generally recognized as inherent in work of the character provided under this Agreement.

Client shall provide to ARCADIS all plans, maps, drawing and other documents identifying the location of any subterranean structures on the Site. Prior to location of any drilling or excavation below the ground surface, ARCADIS shall obtain the concurrence of the Client as to the location for such drilling or excavation.

Should: (i) concealed conditions be encountered in the performance of the Services; (ii) concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iii) unknown physical conditions below the surface of the ground differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided under this Agreement; then the amount of this Agreement and/or time for performance shall be equitably adjusted by change order upon timely notice.

INSERT INTO ALL DRILLING, EXCAVATION, INTRUSIVE WORK SUBCONTRACTS.

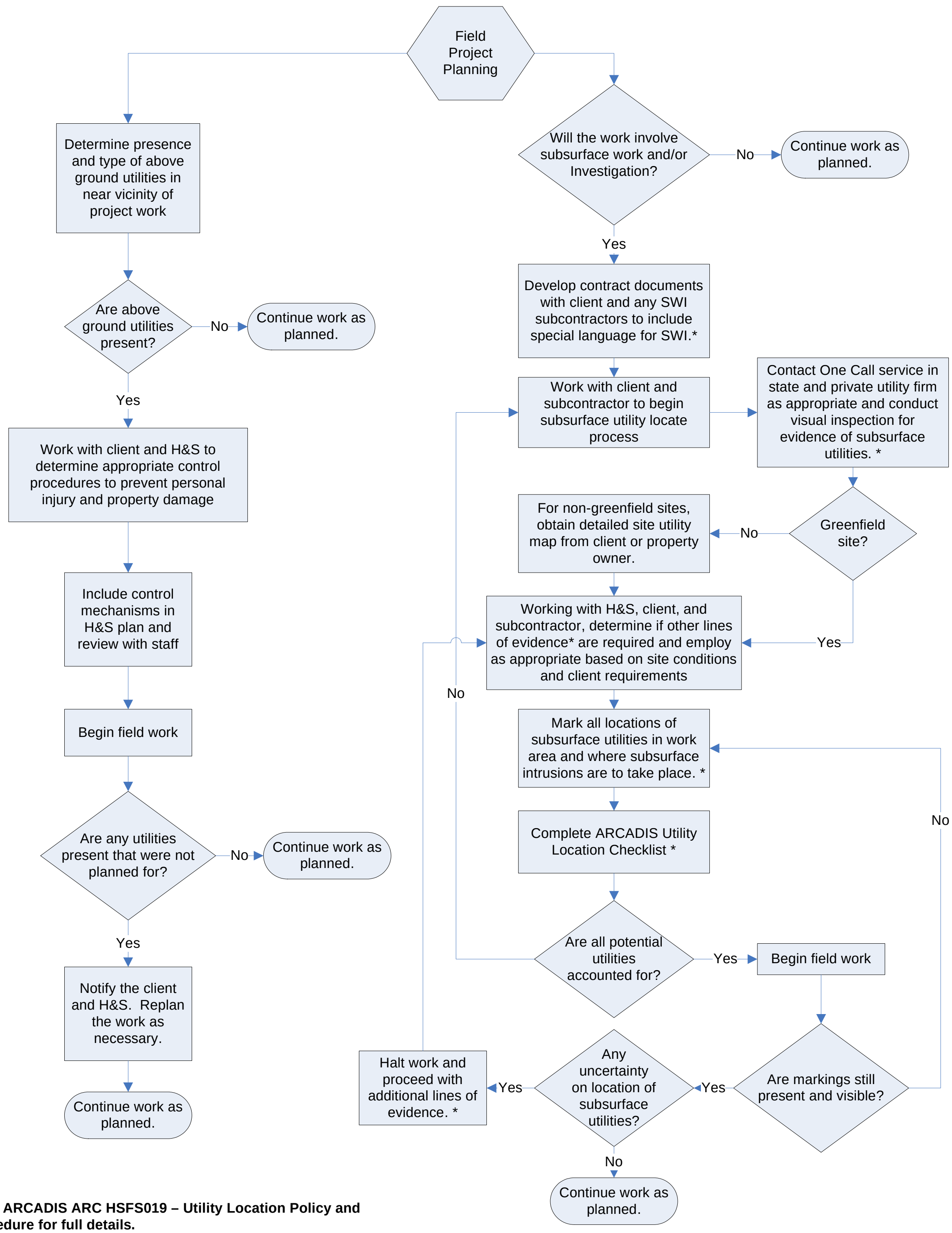
Site Conditions: SUBCONTRACTOR acknowledges that time is of the essence with respect to the performance and completion of its work under this Contract. SUBCONTRACTOR shall adhere to, commence and complete its work in accordance with any schedule incorporated into this Contract, or any schedule submitted by SUBCONTRACTOR or attached hereto; and with respect to any Changes, out of scope or additional work, SUBCONTRACTOR shall expeditiously perform such work according to any schedule therefore agreed to by the parties. In the event any schedule is incorporated in this Contract or attached to this Contract, SUBCONTRACTOR acknowledges and agrees that such schedule has accounted for all inherent or reasonably anticipated delays, including but not limited to those inherent in obtaining site information, access sufficient labor, supplies, tools, equipment and utilities required for the project work, and SUBCONTRACTOR waives any claim of extra compensation or damages therefore.

Subcontractor represents and warrants that it has had an opportunity to review and/or has carefully examined all necessary drawings, maps, schematics, specifications, governmental restrictions, permits and license requirements, and all applicable laws, regulations and rules relating to the Work to be done and the Site, it surroundings and local conditions, and has made all investigations based on reasonably available information that are necessary to develop a full understanding of the hazards and difficulties which can be encountered and are likely to impact the cost or schedule to perform the Work. SUBCONTRACTOR is thus familiar with conditions at the Site as are pertinent to or which may affect the Work and has been granted the right to conduct, and has conducted, all investigations it deems appropriate to determine that it can fulfill the requirements of this Contract. Notwithstanding any other provision of this Contract, SUBCONTRACTOR assumes the risk of all conditions, as specified in this Contract, that may affect SUBCONTRACTOR'S ability to perform the Work and will, regardless of such conditions, or the expense or difficulty of performing the Work or the negligence, if any, of ARCADIS, with respect to same, fully complete the Work for the stated price without further recourse to ARCADIS. Information on the Site and local conditions at the Site furnished by ARCADIS are not guaranteed by ARCADIS to be accurate, and is furnished only for the convenience of SUBCONTRACTOR.

The discovery of concealed conditions which could not reasonably have been anticipated by the SUBCONTRACTOR from information available to SUBCONTRACTOR may constitute a changed condition, which, to the extent such condition materially affects the cost or schedule to perform the Work, would entitle the SUBCONTRACTOR to a change and an equitable adjustment of the Contract price or time. SUBCONTRACTOR warrants that it shall conduct appropriate investigations to determine, with reasonable certainty, the location of utility and service lines, underground storage systems, and other subsurface structures of any kind before commencement of any drilling, excavation, or other work that has the potential to disturb these structures. SUBCONTRACTOR further warrants that it shall conduct independent field investigations to confirm the location of subsurface structures before commencement of subsurface work and shall not relay exclusively on plot plans or other drawings provided to SUBCONTRACTOR in conducting these investigations.

Exhibit 2 – Utility Location Decision Tree

Exhibit B- Utility Location Decision Tree*
(PMs or TMs are required to follow both sides of flowchart)



*** See ARCADIS ARC HSFS019 – Utility Location Policy and Procedure for full details.**

Exhibit 3 - Utilities and Structures Checklist

Project:		**Project Number:**
Site Location:		**Date:**

Instructions: This checklist will be used as a safety measure to insure that all underground utility lines, other underground structures as well as above ground utilities are clearly marked out and identified in the area selected for boring or excavation. **DRILLING, EXCAVATION, OR ANY TYPE OF GROUND INTRUSIVE WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Pre-Field Work Requirements		
Was the state one-call notified with the required advanced notice (usually 48 to 72 hours) (or 811 Nation-wide number)	YES	NO
State one-call confirmation number		
List utility companies who do not participate in the state one call program. Were they contacted directly?		
What additional lines of evidence are used for utility clearance?		
Was a plot plan showing site features and subsurface utilities provided by the PM/TM?	YES	NO
Subgrade Utility Line Location		
Where is the gas line located?		
Where is the gas meter located on the site building(s)?		
Are the electric lines subsurface or overhead? Where are they located?		
Where is electric meter located on the site building(s)?		

Where are the telephone/cable lines located? Are there any overhead lines?	
Where do these lines enter the site building(s)?	
Where are the water lines located?	
Does the site occupant use water (bathrooms, industrial uses, fire suppression, etc.)? If so where do the water lines enter the building for these purposes?	
Are there small manholes/vault covers indicating water lines? If so, where?	
Was the local municipality contacted to mark sanitary lines?	
Where are the sanitary lines located?	
Where might the sanitary lines enter the building? (i.e. what side of the building are the bathrooms, kitchens, water treatment plant, etc?)	
Where are the storm sewer lines located?	
Are there storm sewer inlets located on the property? Check inlets for direction of subsurface lines.	
Are there any gutters directing storm water to the subsurface? Evaluate for direction of lines.	
Underground Storage Tank Sites	
Where are the USTs located? How many USTs are at the site (very number of USTs by counting fill ports and vent lines)?	
Where do the vent lines run?	
Where does the piping run? (Evaluate the path between USTs to dispenser islands).	
Where are the sub-surface electrical lines located which feed power to the UST system?	
General Underground Utility Location Signs	
Are there any cracks resembling straight lines that may indicate the settling of utility lines?	

Are there any patched areas where subsurface repairs may have been conducted?	
Are there any manhole covers or valve boxes that are not associated with marked lines?	
Above ground Utility Line Location	
Are there overhead power lines? If, so where are they located?	
What is the voltage of the overhead power lines?	
Are there any above ground structures (utilities, piping, etc.) that are used by the client? If so, are they located proximal to the work area?	
Do these lines need controlled (locked out) or protected prior to starting work?	
Interviews: Site Owners/Occupants MUST be interviewed for location of private utility lines at the site (if practicable) before start of work	
Name of Owner/Occupant.	
How is this person affiliated with the Site?	
Who interviewed Owner/Occupant?	
Date of Interview	
Specific comments that should be noted from the interview:	

NOTE: If any subsurface utilities listed above are not located, do not proceed with subsurface activities. Contact PM/TM immediately.

Name and signature of person who conducted utility line checklist

Name (print)	**Signature**	**Date**

Exhibit 4 - Use and Limitations of Utility Locating Methods

Ground Penetrating Radar (GPR)

The GPR system transmits high frequency electromagnetic waves into the ground and detects the energy reflected back to the surface. Energy is reflected along boundaries that possess different electrical properties. Reflections typically occur at lithologic contacts or where subsurface materials have high electrical contrasts, including metal objects such as underground storage tanks (USTs), drums, and utility pipes. These reflections are detected by the antenna and are processed into an electrical signal that can be used to image the subsurface feature. The GPR data will be reviewed in the field to assist in the delineation of potential piping or other subsurface structures.

The detection of subsurface structures located at the site depends on the electrical properties of the soil and the structure's depth, diameter, and composition. GPR is limited to the detection of smaller diameter pipes with depth. Generally, a pipe must increase in diameter by one 1 inch for each foot in depth to be seen using GPR. Also, plastic piping is more difficult to detect than metal piping using GPR, and caution should be used if plastic utility lines are suspected.

Radio Frequency Detection (RFD)

This instrument operates on the principle of radio frequency transmission and detection. The transmitter applies a known frequency to the pipe and the receiver is able to detect this frequency along the length of the structure. The success of RFD in tracing underground utilities is based on the composition of the structure (metal or plastic) and the ability to accurately position the transmitter unit so that it can be attached to, or placed directly over the structure. RFD should only be used to verify the location of utility mark-outs, and not as the primary method of utility identification.

Soil Vacuum Excavation

This method uses nondestructive vacuum excavation methods to create a visual test hole allowing the confirmation of buried utilities. This method is very accurate and relatively fast and can be performed prior to or during the drilling program. The limiting factors for this method are cost and availability. As with specialty drilling methods, a limited number of firms have the equipment to perform vacuum excavation.

The location of the structures to be cleared relative to the source and depth of impacted soil or groundwater is considered. If the zone to be cleared is known not to contain hazardous vapors or petroleum hydrocarbons via previous testing, continuous air monitoring is implemented using a lower explosive level (LEL)/O2 meter and photoionization detector (PID) or flame ionization detector (FID) to the depth of the boring. Also consistent with the site health and safety plan (HASP), air monitoring should be conducted continuously with the LEL/O2 meter during any activity if flammable or explosive vapors are suspected to be present. Prior to any subsurface investigation activities, air monitoring should be conducted to establish background levels for total organic vapors using a PID or FID. All work activity must STOP where tests indicate the concentration of flammable vapors exceeds 10% of the LEL, and the source of vapors must be investigated.

Vacuum-assisted soil excavation utility clearance will not be used in areas know to contain hazardous vapors or petroleum hydrocarbons unless the equipment to be used is suitable for flammable/explosive atmospheres. There is a significantly increased risk of explosion if these materials are encountered while performing this type of utility clearance. Cautions will be performed, as identified below.

Cautions

Many vacuum systems that are commonly used for utility clearance are considered unsuitable for use for environmental investigation sites. Most vacuum units are “Not for use with Hydrocarbons, Explosives, Corrosive or Toxic Material,” and are “Not Intrinsically Safe.”

Given that many units and associated tanking are not explosion-proof, the following steps will be considered prior to using vacuum- assisted utility clearance units where soils could be impacted with petroleum hydrocarbons or flammable vapors.

1. Request from the manufacturer and/or the contractor doing the work to supply manufacturers’ documentation and specifications for use of the unit at environmental sites.

2. Request documentation that the unit is intrinsically safe and may be used in areas where petroleum hydrocarbon may be present.

3. Obtain the procedures for grounding portable units to discharge potential static electricity during operation.

4 If none of the above are available, then hand auger instead and do not use vacuum-assisted methods.

Exhibit 5 - Emergency Action Plan Guidelines

When work activities result in the contact or compromise of a utility line, an appropriate response is critical to prevent injury, death or significant property damage. Although circumstances and response vary depending on site specific conditions, the following guidelines provide information that is factored into emergency action planning associated with utility damage. In any event, emergency planning is coordinated with the entity that owns the utility and the client prior to the start of work. This planning and the appropriate response actions are documented in the project health and safety plan and reviewed with all field staff.

Contact with Above or Underground Electric

Contact with above ground or underground electric lines may result in the equipment being energized. Field personnel do not assume rubber tires on equipment are insulating the equipment from the ground. For underground electric strikes, contact with the line may not be immediately noticeable but indications of a strike include: power outage, smoke, explosion, popping noises, or arching electricity. If contact with an electric line is made or is suspected, the following guidelines are followed:

- Under most circumstances, the equipment operator or any worker on a seat of the equipment should stay on the equipment. These workers should not touch anything, especially metal, on the equipment.
- If it is determined that the equipment should be vacated due to a life threatening circumstance, the worker(s) should jump clear as far as possible from the equipment. When jumping keep both feet together and hop away to a safe distance after landing on the ground. Do not use hand holds or touch any part of the equipment when preparing to jump off.
- Workers on the ground should move away from the equipment.
- Keep others away from the equipment and the area.
- If anyone is injured and in contact with the line or equipment, any attempted rescue should be performed with extreme caution. Only use long, dry, clean, unpainted pieces of wood or fiberglass pole or long dry, clean rope to retrieve the victim. Perform first aid/CPR only after the victim is sufficiently clear from the electrical hazard.
- Notify the electric utility or the client as appropriate for the site. Call 911or the client’s emergency response phone number, as appropriate, for any serious injury or any situation that may result in fire or other hazard that could produce injury or property damage.

Natural Gas

If a natural gas line of any size is compromised, immediately:

- Shut off the equipment and remove any other ignition sources.
- Evacuate the area as quickly as possible.

- DO NOT attempt to turn off any gas valves.
- Call 911 or the designated client emergency response number as appropriate.
- Call the gas utility, if site response is not controlled by the client.
- Do not return to the area until permitted by the utility or by the approved client emergency response personnel, as appropriate.

Water Lines (all types)

Compromised water lines may rapidly become a significant hazard especially if the line is under considerable pressure. Ruptured pressurized water lines may undermine and wash out unconsolidated materials beneath equipment or structures causing them to become unstable. If a pressurized water line is ruptured, the following guidelines should be followed:

- Promptly shut off all equipment.
- Lower masts or other high extension components of the equipment.
- Evacuate area and call the water utility or client emergency response number, as appropriate.
- Turn off the water if the valve location is known and on the site property.
- If potable water lines have been ruptured, attempt to divert any flow away from structures prone to being flooded. Use caution and keep a safe distance from the line break since the ground surface may be compromised.
- For raw process water or other water of unknown quality, do not attempt to divert or contain. Avoid skin contact or accidental ingestion of any water.
- When returning to the area of the break, survey the area for signs of compromised land surface (cracks in asphalt or concrete, depressions in ground, observations of undercutting, etc.) and avoid moving any equipment until these conditions are repaired or resolved.

Sewers (all types)

Use the same general guidelines for water lines when responding to compromised sewers. If a sanitary sewer is compromised additional guidelines should be followed to avoid contracting any bacterial illnesses. These include:

- Promptly evacuate the area.
- Avoid contact with any sewage material.
- If contaminated, promptly was with soap (antimicrobial) and water and promptly change impacted clothing.

- If sewage is accidentally ingested or infiltrates any breach of the skin or enters the eyes, seek medical attention as a precautionary measure.

- Decontaminate equipment with commercially available disinfectant solutions or a 10% chlorine bleach solution.

Communication Lines

Contact and compromise of communication lines are generally considered more of a financial concern than a concern associated with injury. However, eye damage may occur if looking into the ends of a cut fiber optic line. Do not look into the ends of fiber optic lines or other communication lines of unknown type. Promptly contact the communication company owning the line.

Product Lines and Underground Storage Tanks (all types)

Compromise of a product line or underground storage tank (UST) requires immediate action to mitigate impact to the environment. For gasoline stations and similar facilities the following guidelines should be followed during a line or UST breach:

- Immediately shut down equipment and turn off the emergency shutoff switch for the facility dispensers.

- If there are no injuries, attempt to contain any flowing product using absorbent materials and/or by physically pumping or bailing product out of the breached area.

- If product is flowing on the surface away from the break area, attempt to protect downgradient storm drains, sewer drains, and surface water features form impact of the petroleum product using any readily available materials.

- If the bottom of a UST has been breached, immediately contact a pump truck to remove product from the affected UST.

- For releases involving diesel fuel, care will be taken to avoid any situation where diesel may be injected into the body from impalement by coated nails, wood splinters, etc. If diesel is injected into the body, seek prompt medical attention, even if no apparent symptoms of a problem exist.

- Clear area and arrange for prompt repair.

For industrial sites with lines or USTs containing multiple products with varying hazards, similar guidelines may be followed as above if the material encountered is known and workers have a fundamental understanding of the hazards associated with the material. Upon discovery of a line or UST breach due to work activities at these sites:

- Immediately stop work and notify the client representative or call the client designated emergency number. For abandoned sites call 911.

- If the material is not known, promptly evacuate the area and let HAZMAT teams deal with the release.

Electrical Safety

1. POLICY

Minimizing the risk of incidents is the fundamental criterion to be satisfied when working on, performing maintenance activities on, and/or installing electrical equipment. The core criteria to this policy are as follows:

- Anything that has been, could be, or is charged with electricity is considered to be energized until the employee knows with certainty that it is no longer energized and cannot be energized during the time ARCADIS staff is in contact with or in the vicinity of that item.

- Appropriate safe work practices and controls, as required by this policy and associated ARCADIS procedures, are employed to prevent electric shock, arc flash burns or other injuries resulting from either direct or indirect electrical contacts. Specific work practices and controls are to be consistent with the nature and extent of the associated electrical hazards.

- All servicing of electrical equipment shall be performed by qualified persons who operate in strict compliance with ARCADIS electrical safety requirements, including Lockout/Tagout (LOTO), arc-flash, and shock hazard safety requirements. Qualified individuals shall possess working knowledge of the various systems upon which work is being performed.

- Routine work is planned carefully, following the ARCADIS TRACK process, and scheduled well in advance. Work assignments are planned to include the competently qualified personnel to perform the work. All electrical work will only be performed once all appropriate equipment has been procured, including all required PPE and analytical equipment (appropriately-rated digital voltmeter, etc.) and LOTO equipment, as appropriate.

- When emergency work is required (including trouble-shooting), electrical safety is not compromised in favor of maintaining the project schedule or budget. Equipment outages (including de-energization and LOTO) are scheduled in lieu of working on energized equipment, whenever possible. When power shutdown is not possible a signed live work permit from an authority in responsible charge must be provided (Exhibit 2).

- No ARCADIS employee works on or installs electrical equipment that requires electrical power source of equal to or greater than 480 volts unless appropriately qualified and approved by ARCADIS Corporate H&S.

This Electrical Safety Policy does not include design requirements for electrical equipment and/or work on or directly associated with electrical generation, transmission, or distribution installations. The PLC panels that ARCADIS designs/builds are excluded from this policy/procedure as this work is covered by other standard requirements established by the ARCADIS Technical Knowledge and Innovation group.

2. PURPOSE AND SCOPE

2.1 Purpose

2.1.1 Prevention

The basic purpose of the ARCADIS electrical safety HSP is to prevent accidents, injuries and equipment damage. Electrical accidents are caused by a combination of the following controllable factors:

- Insufficient training or knowledge of the hazards and hazard controls
- At-risk behaviors or work practices
- Inappropriate equipment and/or installation
- Workplaces made unsafe by the environment
- Insufficient preparation for the expected task

There are various physical controls protecting personnel from the hazards related to electricity including: insulation, guarding, grounding, de-energizing equipment and electrical protective devices. In addition, administrative procedures such as safe work-practices, employee training, routine maintenance, inspections and program audits also provide administrative controls to appropriately and adequately protect ARCADIS personnel. This HSP sets forth minimum requirements for ARCADIS personnel to conduct work involving electricity.

2.1.2 Defining Hazards

This HSP addresses electrical work as the hazardous energy source. The HSP make reference to the control of hazardous energy LO/TO program and employees covered by this standard must also follow the ARCADIS LO/TO HSP ARC HSFS004.

2.1.3 Providing Guidance

The policy and procedures also provide guidance and minimum training and competency requirements for ARCADIS employees, who potentially face a risk of electrical shock, arc flash, or related injuries, when they are working with or are in/and around electrical equipment.

2.2 Scope

2.2.1 HSP Application

The HSP for conducting electrical work apply to every project and all operations conducted at ARCADIS offices, project sites, client facilities, and any other work-related location where ARCADIS employees carry-out activities that directly or indirectly expose these employees to hazards of electricity.

2.2.2 Exposure

This HSP applies to all ARCADIS US work operations conducted involving electrical systems where employees may be exposed to energized parts and/or those parts that have been de-energized.

3. DEFINITIONS

There are several definitions associated with this policy and associated procedures. These definitions are presented in Exhibit 1 of this document.

4. RESPONSIBILITY

4.1 PICs, Project Managers, Task Managers and Corporate Service Managers

Are responsible for implementing this HSP on any project that poses electrical hazards to ARCADIS employees or employees of its subcontractors, clients, and other organizations present in the vicinity of work controlled by ARCADIS. These individuals are responsible for communicating and appropriately managing subcontractors, ensuring that employees have appropriate training and qualifications, and for reviewing all opportunities of electrical work performed by or supervised by ARCADIS as specified in this policy and procedure. These individuals are responsible for involving the appropriate ARCADIS H&S Staff and for ensuring that all subcontractors have been communicated with concerning the minimum H&S requirements for the activity involving electricity.

4.2 Division HS Directors

Are responsible for communicating with all PICs, PMs, APMs, Location Leaders, and Corporate Services Managers within ARCADIS and ensuring they are aware of this HSP and for ensuring it is being implemented effectively**.**

4.3 Operations Managers and Supervisors

Operations managers and supervisors that have oversight management for the health and safety of employees in their respective operations assures that appropriate time is provided to facilitate the development of electrical control procedures and for personnel training.

Note: OSHA requires that any work being done on live voltage systems greater than 50 volts be accompanied by a completed live work permit, signed by a person of authority in responsible charge, and with reason as to why the equipment must be worked on live and energized. The permit used by ARCADIS is presented in Exhibit 2 of this document. NFPA 70E specifically stipulates that troubleshooting activity by "qualified persons" is exempt from this requirement; however, the ARCADIS HSP requirements exceed those of NFPA 70E and OSHA.

4.4 ARCADIS Employees

ARCADIS employees are responsible for implementing the TRACK (**T**hink through the task, **R**ecognize the hazard, **A**ssess the risk, **C**ontrol the risk, **K**eep H&S first in all things) process before any and all work related to electricity and adhere to this electrical policy and associated electrical procedures set forth by ARCADIS Corporate H&S and communicate H&S concerns, issues and questions to their supervisor or their respective Health and Safety contact prior to initiating work.

5. PROCEDURE

5.1 Procedure

The following elements support this ARCADIS Electric Safety HSP. Each element, briefly described below, has its own detailed procedure and is associated with this policy.

5.1.1 Electrical Energy Control Program

An Electrical Energy Control Program is established for each project or activity where ARCADIS personnel (including subs) perform work on devices with electrical energy sources. This program consists of energy control procedures (including the identification of the hazardous energy sources as required by the Control of Hazardous Energy Standard - ARC HSFS004), employee training requirements, and periodic inspections to ensure that before any employee performs any servicing (trouble-shooting, and includes the testing of this equipment during the build-out) or maintenance on a machine or equipment where the unexpected energizing, startup or release of stored energy could occur and cause injury, the machine or equipment shall be isolated from the energy source and rendered inoperative. The Electrical Energy Control Program also includes a general section on installation requirements and safeguards.

This Electrical Energy Control Program can be part of the project's health and safety plan.

5.1.2 Electrical Energy Control Procedure

An Electrical Energy Control Procedure is developed, documented and utilized for the control of potentially hazardous electrical energy when ARCADIS personnel are engaged in the installation testing, servicing (trouble-shooting) and/or maintenance of equipment. The Electrical Energy Control Procedure includes specific requirements for the installation of electrical equipment. This procedure serves as the Electrical Energy Control Procedure.

5.1.3 Protective Devices

Protective Devices (e.g. locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware) and **Personal Protective Equipment (PPE)** is provided, specified in each Electrical Energy Control Procedure, and used by ARCADIS personnel. These devices and PPE are used for isolating, securing or blocking of machines or equipment from electrical energy sources, and during servicing (trouble-shooting) equipment, and installation of this equipment.

5.1.4 Assessment Procedure

An Assessment Procedure is developed to cover the specifications required for periodic assessments. These assessments, to be conducted (at least annually) of each project employing Electrical Energy Control Procedure(s), ensures that the Electrical Energy Control Procedure(s) and the requirements of Electrical Energy Control Program are being followed.

5.1.5 Electrical Safety Training

ARCADIS provides Electrical Safety Training to include the arc flash safety training to appropriate personnel to ensure that the purpose and function of the Electrical Energy Control Program and Procedures are understood and that the knowledge and skills required for the safe operation (including, servicing, maintenance, and installation) are acquired.

5.1.6 Outside Personnel

Whenever outside servicing personnel (Contractors/Subcontractors) are to be engaged in activities covered by the control of hazardous energy sources (re: Control of Hazardous Energy Standard- ARC HSFS004) and this HSP, ARCADIS and the outside servicing employer shall inform each other of their respective energy control procedures

Per NFPA 70E, when ARCADIS contracts with a subcontractor to perform electrical work, it serves as the Host Employer and has certain responsibilities and will inform the subcontractor of:

- Known electrical hazards that are related to the subcontractor's work, and that might not be recognized by the subcontractor or its employees

- Information about ARCADIS' installation that the subcontractor needs to make the appropriate electrical hazard assessments and analyses

In addition, ARCADIS will report observed subcontractor-related issues related to electrical safety as appropriate.

The ARCADIS subcontractor will:

- Ensure that each of its employees is instructed in the hazards communicated to it by ARCADIS in addition to ensuring that its employees meet all training and qualification requirements of NFPA 70E and OSHA.

- Ensure that each of its employees follow the work practices required by this HSP, the NFPA 70E standard, and the project HASP.

- Advise ARCADIS of:

  - Any unique hazards presented by the subcontractor's work.

  - Any unanticipated hazards found during the subcontractor's work that ARCADIS did not mention.

  - The measures the subcontractor took to correct any issues identified or raised by ARCADIS to the subcontractor and to prevent them from occurring again.

5.2 Electrical Energy Control Program

This Electrical Energy Control Program procedure provides general information and work requirements for ARCADIS employees working on projects. A project-specific Electrical Energy Control Program, which includes an electrical safety analysis to be performed as part of the Health and Safety Plan (HASP) development, is established for each project site where ARCADIS' personnel perform work on hazardous energy sources. The following elements are required in a project-specific Electrical Energy Control Program:

5.2.1 General Requirements

- All electrical equipment used on the project or activity is listed by a national testing laboratory for the specific application for which it is used.

- All electrical equipment is inventoried and listed in the project Health and Safety Plan (HASP).

- All electrical equipment (e.g. switchboards, panel boards, industrial control panels, motor control centers, etc.) in areas that are likely to require examination, adjustment, servicing (trouble-shooting), or maintenance while energized, are labeled to warn qualified persons and others of the potential electrical shock and arc flash hazards. The marking label will be located on the equipment so that the label is clearly visible to those qualified person(s) performing work or those who are not qualified. Examples of marking labels are provided in Exhibit 1.

  – *Note:* Exempted from arc and shock labeling requirements are equipment or appliances which are equipped with a cord and disconnectable plug or which operate on 120V alternating current (AC) or less. Such equipment is to be serviced in the totally de-energized state by unplugging the AC cord.

  – Safety-related work practices are employed by qualified persons to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits that are or may be energized (consistent with their training and with specific energy control procedures).

- The specific safety-related work practices are consistent with the nature and extent of the associated electrical hazards.

- System enclosures containing multiple energy sources are required to be appropriately labeled with a label warning of multiple energy sources, and directing operation personnel to the procedure for eliminating all alternate sources of energy.

- Live parts to which an employee may be exposed are de-energized before the employee works on or near them, unless it is demonstrated that de-energizing introduces additional or increased hazards or is infeasible due to the work requiring the equipment to be energized, equipment design or operational limitations.

- Live parts that operate at less than 50 volts to ground need not be de-energized if there is no increased exposure to electrical burns or to explosion due to electric arcs.

- Visual inspection of portable cord and plug connected equipment and flexible cord sets (extension cords) is conducted before use on any shift for external defects (such as loose parts, deformed and missing pins, or damage to outer jacket or insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket). Cord and plug connected equipment and flexible cord sets (extension cords) that remain connected once they are put in place and are not exposed to damage need not be visually inspected until they are relocated.

- If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item are removed from service, and no employee may use it until repairs and tests necessary to render the equipment safe have been made.

- When an attachment plug is to be connected to a receptacle (including on a cord set), the relationship of the plug and receptacle contacts shall first be checked to ensure that they are of proper mating configurations.

- If the exposed live parts are not de-energized (e.g., for reasons of increased or additional hazards or infeasibility), other safety-related work practices are used to protect employees who may be exposed to the electrical hazards involved.

- Such work practices serve to protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object.

- When working in damp or wet environments, only Ground Fault Circuit Interrupters (GFCI) or GFCI protected receptacles shall be used.

- Employees may not enter spaces containing exposed energized parts, unless illumination is provided that enables the employees to perform the work safely. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees may not perform tasks near exposed energized parts. Employees may not reach blindly into areas which may contain energized parts.

- Conductive articles of jewelry and clothing (such a watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) may not be worn if they might contact exposed energized parts. *Note: However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means.*

- For conductive materials and equipment that are in contact with any part of an employee's body, employees are instructed (through daily tailgate meetings, job briefings, review of the health and safety plan, etc.) to handle these materials/equipment in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, the work practices will be instituted (such as the use of insulation, guarding, and material handling techniques) to minimize the hazard.

5.2.2 Working on or Near Exposed De-energized Electrical Equipment Requirements

See ARCADIS Standard Operating Procedure ARC HSFS004 - Control of Hazardous Energy for LO/TO requirements.

5.2.3 Disconnecting and Over-current Protection Requirements

- All circuits are protected from over-current conditions based upon the current-carrying capacity of the conductors being used. *Note:* The only grounded conductor that can be opened without opening all other phase conductors is the control circuit neutral of a starter via an auxiliary contact of the overload but only if the overload relay and motor contactor are in the same enclosure.

- No overcurrent devices are incorporated into any permanently grounded conductor unless the device opens all conductors simultaneously.

- Overcurrent protection devices, circuit breakers, and disconnect switches are placed so that they are readily accessible for maintenance and use, reasonably protected from physical damage, and located, shielded, or enclosed to prevent personal injury from arcing, moving parts, or accidental operation. No easily ignitable materials are placed in the vicinity of any overcurrent protection devices.

- Circuit breakers and disconnect switches are clearly labeled to indicate the energized and de-energized positions, as well as the equipment or circuit it supplies. All circuit breaker panels fuse boxes, and control panels are securely mounted and constructed with close fitting doors or panels to prevent unauthorized access or injury.

- All circuit breaker fused switches and non-fused switches used as a disconnect means shall be capable of being locked in the off position.

- All electrical panels, devices, and boxes located out of doors or in wet locations are placed in a weatherproof enclosure or cabinet.

5.2.4 Grounding Requirements

- All electrical circuits are grounded in accordance with NEC and National Electric Safety Code (NESC) regulations. Any conductor used as a ground is clearly identifiable and distinguishable from all other conductors.

- Any grounded conductor or grounding terminal on a receptacle, cord, or device is not utilized for any purpose other than grounding.

- All grounding rods are tested after installation with a suitable earth/ground resistance tester to ensure minimal resistance (25 ohms or less). If the resistance measurement is greater than 25 ohms, an additional grounding rod must be installed at least 6 feet from the original grounding rod, and bonded together (with the correct size bonding jumper according the sizing table of Article 250) to create one grounding electrode.

- Equipment grounding conductors shall be sized not less than the minimum conductor size listed in the equipment grounding conductor sizing table of Article 250 of the latest edition of the NEC. *Equipment grounding conductors are sized based on the overcurrent protective device and not the ungrounded conductor size.*

- When temporarily bonding and grounding equipment, the leads are attached to the grounding point first. When disconnecting temporary bonding or grounding leads, disconnect the grounding point last. Appropriate PPE must be worn according to NFPA 70E safe work practices.

- The equipment end is attached and removed using insulated tools or similar means.

- Prior to use, all equipment, receptacles, electrical power tools, portable light strings, cord-sets, etc., are inspected and instrument tested by a qualified person to ensure ground circuit continuity.

- Additional tests are performed prior to returning equipment to service following repairs, or an incident that may have caused damage, or at intervals not to exceed three months. All tests are recorded, including equipment type and number, repairs made, and date of test. No equipment, tool, or devices are put into service if damaged.

- All portable tools, lights, or devices utilize three-conductor, grounded cord-sets unless protected by an approved system of double insulation. All temporary 120-volt, single phase, 15- and 20-ampere receptacles are installed with GFCI for personal protection. GFCI receptacles shall be tested to ensure proper operation. If the test button does not trip the receptacle, a portable *in-line* GFCI protective device shall be used.

- Where permanent receptacles are installed without GFCI protection, in-line GFCI receptacles are utilized between the permanent receptacle and the portable powered device.

5.2.5 Temporary Wiring Requirements

- General
  - A certified, licensed electrician installs temporary wiring.
  - Any portable lighting units will have a protective guard surrounding the light bulb.
  - Spent light bulbs are replaced promptly and disposed of according to federal, state, provincial, local jurisdiction, or client requirements.
  - No exposed or empty sockets are permitted.
  - If any receptacles are required for use in wet locations, they are contained in a weatherproof enclosure. The integrity of the weatherproof enclosure is not affected when a plug is inserted.
  - Extension cords are not fastened with staples, hung from nails, or suspended by wire.
  - Temporary light strings are not suspended by their cords unless specifically designed for that purpose. Each lamp is equipped with a suitable guard.
  - All temporary lighting exposed to wet or hazardous conditions in confined spaces are operated at a maximum of 12 volts and protected by an approved switch near the entrance to interrupt the power in the event of an emergency.
  - Extension cords are placed so as not to be damaged by sharp objects, moving equipment, or excessive heat. *Note:* Multiple extension cords should not be used to extend the overall length. An extension cord current rating is based on

the cord's length. A short cord will have smaller conductors for a given current rating than a longer cord of the same current rating. This is due to the impedance of the conductor. A shorter cord has less impedance. The manufacturer picks a conductor size at the cord length that when the rated current is applied to the cord, the voltage drop is insignificant. If the cord is extended by plugging in another cord, the impedance goes up and in order to have no appreciable voltage drop, the current, must be less. If the same current were applied to the extended cord, it could overheat. Therefore, a cord should be selected with the length needed for the current rating needed. Longer cords for a given current rating have larger conductors than shorter cords for the same current rating.

– Connectors are placed above ground and protected from water, and cords are either suspended above walkways or covered to eliminate tripping hazards and protect the cord from damage.

– Cords are not suspended by conductive material.

– All cord sets used in wet locations will have approved plugs molded to the cord insulation, and all receptacles used in wet locations are contained in a weatherproof enclosure that is not affected when a cord-set is inserted.

5.2.6 Working Space about Electric Equipment

- Sufficient access in the vicinity of and working space is provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment. See the most current NEC for working clearance requirements.

- The dimension of the working space in the direction of access to live parts operating at 600 volts or less and likely to require examination, adjustment, servicing (trouble-shooting), or maintenance while alive may not be less than indicated in Table A. In addition to the distances shown in Table A, workspace may not be less than 30 inches wide in front of the electric equipment. Working space is not required in back of assemblies such as dead-front switchboards or motor control centers where there are no renewable or adjustable parts such as fuses or switches on the back and where all connections are accessible from locations other than the back.

Table A - Working Clearances

	Minimum Clear Distance for Condition (ft)		
Nominal voltage to ground	a	b	c
0-150	3	3	3
151-600	3	3 ½	4

Conditions a, b, and c, are as follows:

Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating material. Insulated wire or insulated bus-bars operating at not over 300 volts are not considered live parts.

Exposed live parts on one side and grounded parts on the other side.

Exposed live parts on both sides of the workspace *[not guarded as provided in Condition a]* with the operator between.

5.2.7 Guarding of Live Parts

Except as required or permitted elsewhere, live parts of electric equipment operating at 50 volts or more are guarded against accidental contact by approved cabinets or other forms of approved enclosures. This guarding is to be accomplished by suitable permanent, substantial partitions or screens so arranged that only qualified persons will have access to the space within reach of the live parts. Any openings in such partitions or screens are so sized and located that persons are not likely to come into accidental contact with the live parts or to bring conducting objects into contact with them.

5.3 Training, Qualification, and Equipment Requirements

5.3.1 Qualified Persons

"Qualified Person" definitions:

- Level I: Qualified to work on energized 50 - 120 VAC control systems on qualified sites (Qualified sites have been audited for NFPA 70E Hazard Analysis, and have been assigned a value of 0 or 1 in regards to hazard risk categories as determined by NFPA 70E. Other requirements will be discussed). This is the lowest level of qualified individual in the qualification management system. The prerequisites include training and expertise in the use of a digital voltmeter, schematic diagram interpretation and training in all applicable electrical safety programs, including NFPA 70E and LOTO. This assumes that the employee is equipped with all applicable PPE and all appropriate tools and metering equipment.

- Level II: Qualified to work on energized 120 VAC control systems on qualified sites (see above), and to service de-energized switchgear of operating voltages of up to 600 VAC. This Qualification level allows qualified individuals the opportunity to service deenergized 480 VAC equipment, including such tasks as changing fuses, testing components, visual inspections, etc. It will not permit work on any exposed, energized 480 VAC circuits or switchgear.

- Level III: Qualified to work on energized power systems and controls up to 600 VAC. This includes motor controls, switchgear and variable frequency drives of 600 VAC or less.

- Level IV: Qualified to work on electrical systems of greater than 600 VAC.

- In addition, and this applies to Infrastructure and PM/CM staff who provide oversight of System/Electrical Installs: There will be situations where engineers and/or construction oversight personnel will need to be within the arc flash boundary to perform inspections/oversight of work completed by subcontractors or qualified personnel. These staff will need the NFPA 70e training as well and wear all appropriate PPE as described in the training.

5.3.2 Electrical Hazards

Employees who face a risk of electrical hazards by the electrical installation (e.g., systems that meet the National Electrical Code and OSHA requirements) are trained per the requirements described below. Employees in these groups do not require training if their work does not bring them within the Limited Approach Boundary (as determined by NFPA 70E Table 130.2(C)) of electric circuits—operating at 50 volts or more to ground—for a hazard to exist. *Note:* Persons outside the arc flash boundary wearing no arc flash protection may still receive second-degree burns, which are considered “curable” burns. .

5.3.3 Energized Parts

Qualified persons working on or near exposed energized parts receive training in the following:

- The skills and techniques necessary to distinguish exposed energized parts from other parts of electric equipment.

- The skills and techniques necessary to determine the nominal voltage of exposed live parts.

- The clearance distances specified for working on or near exposed energized parts and the corresponding voltages to which the qualified person will be exposed.

- Trained in the latest requirements of NFPA 70E.

5.3.4 Energized Equipment

Qualified persons’ whose work on energized equipment involves either direct contact, or contact by means of tools or materials, are trained on how to work safely on energized circuits. This training includes the precautionary work practices, personal protective equipment, insulating and shielding materials, and the use of insulated tools.

Exposed live work must not be done without an Energized Electrical Work Permit. (Exhibit 2 and NFPA 70 E, Annex J).

5.3.5 Qualified and Unqualified Employee Training

Training for qualified employees will involve classroom and on-the-job training, as appropriate. This training involves some customization to reflect the scope of work performed within project or type of equipment (e.g. PCL cabinets, etc.). The training course will be approved by Corporate H&S.

Unqualified employees (those who do not work on equipment-including trouble shooting) will at a minimum, complete an approved on-line electrical safety awareness course that discusses to some degree NFPA 70E, including [but not limited to] compliance with the Limited Approach Boundaries for shock protection as determined by NFPA 70E Table 130.2(C).

5.3.6 Training Timeframe

Training is performed before the employee is assigned duties involving work around or on electrical systems (including trouble-shooting).

5.3.7 Ongoing Training

Retraining and refresher training is performed whenever inspections indicate that an employee does not have the necessary knowledge or skills to safely work on or around electrical systems. Retraining is also performed when policies or procedures change and/or new equipment or systems are introduced into the work area.

5.4 Personal Protective Equipment Related to Hazard Analysis and Hazard Risk Category Classification

To determine the appropriate PPE necessary to conduct electrical work on energized equipment, it is necessary to complete an electrical hazard analysis of the equipment as discussed in section 5.2. This hazard analysis will be conducted on projects where exposed energized equipment will require maintenance, troubleshooting or be encountered. The hazard analysis will result in determining Hazard Risk Categories of 0 through 4 by applying Tables 130(C)(9) in the current NFPA 70E. Based on the determined category, the appropriate PPE will be specified for the job as specified in the table shown in Exhibit 3:

6. REFERENCE DOCUMENTS AND ASSOCIATED PROCEDURES

6.1 National Electrical Code (NEC) - NFPA 70

The NEC is the accepted standard for protection of persons and property from electrical installations. Familiarization with NFPA 70 is required for any one whose responsibility is designing, installing, verifying and maintaining safe and compliant electrical systems. Information can be found through the NFPA website with a membership or printed and electronic versions of the code can be purchased from NFPA and other suppliers.

6.2 National Electrical Installation Standards

The NEIS gives definition to "neat and workmanlike manner" as required by the National Electrical Code. Each standard is submitted for approval by the American National Standards Institute (ANSI).

6.3 National Electrical Safety Code (NESC)

The NESC is a product of the Institute of Electrical and Electronics Engineers (IEEE). This code provides information on the installation, operation, and maintenance of electrical systems. The intent of the publication is the safeguarding of persons performing the work. Information, like the NEC, is available with IEEE membership or by buying a printed or electronic version of the code.

6.4 National Fire Protection Association (NFPA)

The NFPA is the definitive source for everything related to fire protection. The association has developed numerous standards that have been adopted by federal, state, and local jurisdictions as enforceable standards. The NFPA website has plenty of free information but more specific information is restricted to members only.

6.5 National Institute for Occupational Safety and Health (NIOSH)

NIOSH is similar in mission to OSHA but differs by the singular perspective that NIOSH is the federal agency responsible for the prevention of work related disease and injury, and is part of the Centers for Disease Control and Prevention.

6.6 Occupational Health and Safety Administration (OSHA)

OSHA is the main governmental source for effective safety practices. The OSHA website is a vast, readily accessible information resource with a thorough search engine.

6.7 NFPA 70E: Standard for Electrical Safety in the Workplace

This standard addresses electrical safety requirements for employee workplaces that are necessary for the practical safeguarding of employees during activities such as the installation, operation, maintenance, and demolition of electric conductors, electric equipment, signaling and communications conductors and equipment, and raceways for the following:

1. Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings

2. Yards, lots, parking lots, carnivals, and industrial substations FPN

3. Installations of conductors and equipment that connect to the supply of electricity

4. Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation or control center.

6.8 Other related ARCADIS Documents:

Control of Hazardous Energy Procedure (ARC HSFS004) Exhibit 2 – Energized Electrical Work Permit

7. RECORDS

- Audit Records
- Inspection and testing records
- Complete Energized Electrical Work Permits

8. APPROVALS AND HISTORY OF CHANGE

Approved by: Mija A. Coppola, Director H&S, Infrastructure and PMCM Divisions

Mija A. Coppola

History of Change

Revision Date	Revision Number	Reason for change
26 March 2007	01	Original document
28 June 2007	02	Enhanced for regulatory requirement additions
6 September 2007	03	Changing over to new template format
25 February 2008	04	Template change
10 March 2009	05	Modified to address elements of NFPA 70E and based on review of procedure. Process improvements

Exhibit 1 - Definitions

Following are terms and definitions used in the electrical safety policy and associated procedures.

Affected Employee - An employee/worker whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lock-out/tag-out, or whose job requires him/her to work in an area where servicing or maintenance is being performed. An affected employee is not allowed to apply or remove locks or tags.

Arc Flash Hazard – A dangerous condition associated with the possible release of energy caused by an electric arc. An arc flash hazard may exist when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc.

Arc Flash Hazard Analysis – A study investigating a worker's potential exposure to arc flash energy, conducted for the purpose of injury prevention and the determination of safe work practices and appropriate levels of PPE.

Arc Flash Protection Boundary – An approach limit at a distance from exposed live parts, within which a person could receive greater than a second-degree burn if an electrical arc flash were to occur.

Arc Flash Suit – A complete Fire Resistant (FR) clothing and equipment system that covers the entire body, except for the hands and feet. This includes pants, jacket and beekeeper-type hood fitted with a face shield.

Authorized Employee - An employee/worker who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. Only authorized employees may apply or remove locks or tags.

Bonding - Bonding is the conductive connection of all non-current-carrying metal parts for the purpose of providing a low-resistance, effective fault-current path from the point of a fault back to the source of electricity, which is the closest transformer upstream from the faulted circuit.

Because of the water factor, it is very important to bond ALL non-circuit metal parts together to form a single bonding path back to the source of electricity.

Cabinet - An enclosure designed either for surface or flush mounting, and provided with a frame, mat, or trim in which a swinging door or doors are or may be hung.

Certified - Equipment is "certified" if it (a) has been tested and found by a nationally recognized testing laboratory (e.g. UL certified) to meet nationally recognized standards or to be safe for use in a specified manner, or (b) is of a kind whose production is periodically inspected by a nationally recognized testing laboratory, and (c) it bears a label, tag, or other record of certification.

Circuit breaker

- 600 volts nominal, or less - A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

- Over 600 volts, nominal - A switching device capable of making and opening a circuit current paths under normal and abnormal circuit conditions, including short circuit conditions.

Conductor

- **Bare** - A conductor having no covering or electrical insulation whatsoever.

- **Covered** - A conductor encased within material of composition or thickness that is not recognized as electrical insulation.

- **Insulated** - A conductor encased within material of composition and thickness that is recognized as electrical insulation.

Device - A unit of an electrical system which is intended to carry or control but not utilize electric energy.

Disconnecting Means - A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Electric Shock Hazard – A dangerous condition associated with the possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.

Energized - Connected to an energy source or containing residual or stored energy.

Energy Isolating Device - A mechanical device that physically prevents the transmission or release of energy, including but not limited to a manually operated electrical circuit breaker, a disconnect switch, a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and no pole can be operated independently, a line valve, a block, and any similar device used to block or isolate energy. Push buttons, selector switches, interlocks, and other control circuit-type devices are not energy-isolating devices.

Energy Source - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy source.

- **Lock-out** - The placement of a lock-out device on an energy isolating device, in accordance with an established procedure, ensures that the energy isolating device and the equipment being controlled cannot be operated until the lock-out device is removed.

- **Lock-out/Tag-out (LOTO)** – The placement of a lock-out device and associated identifying tag on an energy-isolating device, in accordance with an established procedure, to ensure that this device and the equipment being controlled cannot be operated until the lock-out device and associated tag is removed.

- **Lock-out Device** - A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

Enclosed - Surrounded by a case, housing, fence or walls which will prevent persons from accidentally contacting energized parts.

Enclosure - The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.

Equipment - A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like, used as a part of, or in connection with, an electrical installation.

Exposed

- (As applied to live parts.) Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or parts not suitably guarded, isolated, or insulated.

- (As applied to wiring methods.) On or attached to the surface or behind panels designed to allow access.

Ground - A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounded - Connected to earth or to some conducting body that serves in place of the earth.

Grounded conductor - A system or circuit conductor that is intentionally grounded.

Grounding conductor - A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

Grounding conductor, **equipment** - The conductive path installed to tconnect normally non-current-carrying metal parts of equipment together and to the system grounded conductor or the grounding electrode conductor.

Grounding electrode conductor - The conductor used to connect the system grounded conductor or the equipment to a point on the grounding electrode system.

Ground-fault circuit-interrupter (GFCI) - A device intended for the protection of personnel that functions to deenergize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

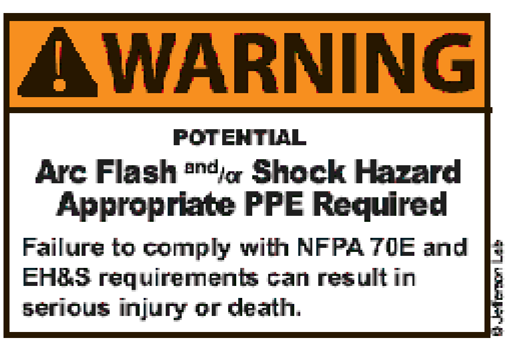
Guarded - Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach to a point of danger or contact by persons or objects.

Incident Energy – The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per centimeter squared (cal/cm^2).

Isolated - Not readily accessible to persons unless special means for access are used.

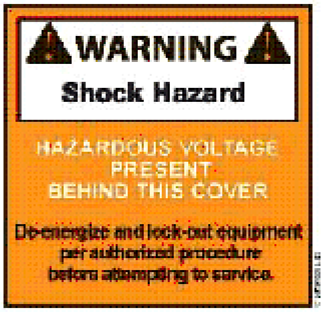
Labeled - Equipment is "labeled" if there is attached to it a label, symbol, or other identifying mark of a nationally recognized testing laboratory which, (a) makes periodic inspections of the production of such equipment, and (b) whose labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

NFPA-70E Example Labels:

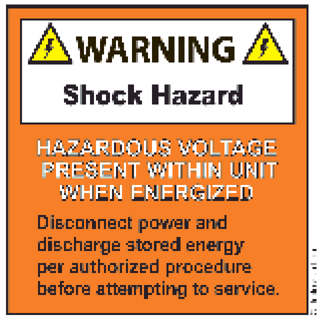


Large Warning Label

Small Warning Label



"Behind this Cover Label"



"Within this Unit Label"

Limited Approach Boundary – An approach limit at a distance from an exposed live part, within which a shock hazard exists. Limited Approach Boundaries are based on phase-to-phase nominal voltage levels and may be found in NFPA 70E Table 130.2(C). Unqualified persons must maintain the Limited Approach Boundary from parts, circuits, or conductors that are exposed and energized.

Listed - Equipment is "listed" if it is of a kind mentioned in a list that (a) is published by a nationally recognized laboratory which makes periodic inspection of the production of such equipment, and (b) states such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

Outlet - A point on the wiring system at which current may be taken to supply utilization equipment.

Overcurrent - Any current level that is in excess of the rated current of equipment or the capacity of a conductor. It may result from overload (see definition), short circuit, or ground fault.

Overload - is a situation where an electrical machine or system is subjected to a greater load than it was designed. This can be caused by short-circuiting, incorrect installation, or misuse such as running a high-current rated appliance off a low- current-rated extension cable. Systems should incorporate suitable overload protection devices to prevent damage should such a situation occur. Fuses and circuit breakers are commonly installed for this purpose.

Other Employees - Personnel other than authorized or affected employees whose work is or may be in an area where lock-out and tag-out procedures may be used.

Personal Protective Equipment (PPE) - Rated protective equipment, including personal protective equipment for eyes, face, head, and extremities; protective clothing; respiratory devices; and protective shields and barriers. Such equipment must be provided, used, and maintained in a sanitary and reliable condition wherever necessary by reason of hazards of processes or environment, chemical hazards, electrical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through adsorption, inhalation or physical contact.

Panel board - A single panel or group of panel units designed for assembly in the form of a single panel; including buses, automatic overcurrent devices, and with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front.

Power outlet - An enclosed assembly that may include receptacles, circuit breakers, fuse holders, fused switches, buses and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles or boats, or to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

Prohibited Approach Boundary – An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the exposed live part. Prohibited Approach Boundaries may be found in NFPA 70E Table 130.2(C). Only qualified persons utilizing rated PPE may enter a Prohibited Approach Boundary.

Qualified person - One familiar with the construction and operation of the equipment and the hazards involved.

- Whether an employee is considered to be a "qualified person" will depend upon various circumstances in the workplace. It is possible and, in fact, likely for an individual to be considered qualified" with regard to certain equipment in the workplace, but "unqualified" as to other equipment. This includes:
  - The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
  - The skills and techniques necessary to determine the nominal voltage of exposed live parts, and
  - Clearance distances and the corresponding voltages to which the qualified person will be exposed.
- An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

Readily accessible - Capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc.

Receptacle - A receptacle is a contact device installed at an outlet for the connection of a single attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is a single device containing two or more receptacles.

Restricted Approach Boundary – An approach limit at a distance from an exposed live part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the live part. Restricted Approach Boundaries may be found in NFPA 70E Table 130.2(C). Only qualified persons may enter into a Restricted Approach Boundary.

Service equipment - The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of supply and cutoff of the electrical service to a premise.

Switchboard - A large single panel, frame, or assembly of panels that has switches, buses, instruments, overcurrent and other protective devices mounted on the face, back or both. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.

Servicing and/or Maintenance - Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, maintaining and/or servicing machines or equipment, including troubleshooting . These activities include but are not limited to lubrication, cleaning or un-jamming of machines/equipment, and making adjustments or tool changes that creates employee exposure to unplanned energizing or startup of equipment, or the release of hazardous energy.

Setting Up - Any work performed to prepare a machine or equipment for its normal production operation.

Tag-out -The placement of a tag-out device on an energy isolating device in accordance with an established procedure to ensure that the energy isolating device and the equipment being controlled cannot be operated.

Tag-out Device - A prominent warning device, including a tag and a means of attachment that can be securely fastened to an energy isolating device in accordance with an established procedure to indicate that the energy isolating device and the equipment being controlled may not be operated.

Testing – Determining that machinery, equipment, or equipment parts are de-energized through the proper application of approved test equipment designed to test for the presence or absence of voltage.

Verify - Operating equipment controls for the purpose of determining that equipment cannot be restarted after an energy-isolating procedure has been performed and before maintenance or repair work is initiated.

Voltage, nominal - A value assigned to a circuit or system for the purpose of conveniently designating its voltage class (as 120/240, 480Y/277, 600, etc.). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

Voltage to ground - For grounded circuits, the voltage between an ungrounded conductor and that point or conductor of the circuit that is connected to earth ground.

Exhibit 2 – Energized Electrical Work Permit

Energized Electrical Work Permit

Part 1. To be completed by the requester: Job/Work Order

Number___________________

1. Description of circuit/equipment/job location:____
2. Description of work to be done:____
3. Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next schedule outage:

____

____

___________________________________ ______________

Requester/Title Date

Part 2. To be completed by the electrically qualified persons doing the work: **Check when complete**

1. Detailed Job Description procedure to be used in performing the above detailed work:

____

____

2. Description of the Safe Work Practices to be employed:____

____

3. Results of the Shock Hazard Analysis:____

____

4. Determination of Shock Protection Boundaries:____

____

5. Results of the Flash Hazard Analysis:____

____

6. Determination of the Flash Protection Boundaries:____

____

7. Necessary personal protective equipment to safely perform the assign task:__________________________

____

8. Means employed to restrict the access of unqualified persons from the work area:______________________

____

9. Evidence of completion of a Job Briefing including discussion of any job-related hazards:_________________

____

10. Do you agree the above described work can be done safely? Yes No (if *no*, return to the requester)

Electrically Qualified Person(s) Date

Electrically Qualified Person(s) Date

Part 3: Approval(s) to perform the work while electrically energized:

Manufacturing Manager Maintenance/Engineering Manager

Safety Manager Electrically Knowledgeable Person

General Manager Date

Note: Once the work is complete, forward this form to the site Safety Department for review and retention.

Personal Protective Equipment Requirements for Work Being Done On Energized Electrical Equipment and/or In Arc Flash Boundary

	Hazard / Risk Category				
PPE	**0**	**1**	**2**	**3**	**4**
Leather gloves	X❶	X❶	X❶	X❶	X❶
Insulated rubber gloves	Depends on activity	Depends on activity	Depends on activity	Depends on activity	Depends on activity
Long sleeve shirt ❷	X	X	X	X	X
Long pants❷	X	X	X❸	X	X
Nomex coveralls		X (min arc rating of 4) **OR**	X (min arc rating of 8) **OR**	X (min arc rating of 8) **AND**	X (min arc rating of 40) **OR**
Fire Retardant - Long sleeve shirt /long pants		X (min arc rating of 4)	X (min arc rating of 8)	X (min arc rating of 8) ❻	X (min arc rating of 40)
Flash suit jacket and pants					X (min arc rating of 40)
Arc rated face shield		X (min arc rating of 4) **OR**	X (min arc rating of 8)❹ **OR**		
Arc rated arc flash suit hood		X	X	X	X (min arc rating of 40)
Safety glasses or Goggles	X	X	X	X ❺	X ❺
Sock hood	Depends on activity	Depends on activity	Depends on activity	Depends on activity	Depends on activity
Hearing protection	X (inserts)	X (inserts)	X (inserts)	X (inserts)	X (inserts)
Hardhat (rated for electrical)		X	X	X	X
Hardhat Liner				X❼	X ❼
Leather boots		X	X	X	X
Meter – Fluke Brand	X	X	X	X	X
Insulated/insulating tools	X	X	X	X	X

If work is being done outdoors, may need arc-rated coats, rainwear, etc.; Cotton undergarments shall be worn for all hazard/risk categories

❶Combination insulated rubber gloves with leather protectors is acceptable

❷ Non-melting (per ASTM F 1506-00) or untreated natural fiber

❸ If using FR pants as noted, long pants of non-melting or natural fiber fabric do not need to be worn; However, if using coveralls as noted, long pants of non-melting or natural fiber **must be** worn

❹Must have wrap around guarding to protect face, forehead, ears and neck

❺Selection required based on activity. See NFPA 70E

❻Other options:

1. Two sets of Nomex coveralls (inner coverall with minimum arc rating of 4 and other one with minimum arc rating of 5) over non-melting or untreated natural fiber long sleeve shirt and pants
2. Total FR clothing system and hood with a minimum arc rating of 25

❼ As required based on activity. See NFPA 70E

Defensive Driving

1. POLICY

ARCADIS considers motor vehicle operation a risk that demands strict management to lead to accident prevention and the resultant decrease in employee injuries, lost productivity and insurance costs to be a vital key in accomplishing our company's vision. Motor vehicle accident prevention involves the safety and well-being of our employees as well as the general public.

To that end, it is the policy of ARCADIS that defensive driving skills and techniques be implemented by all of its employees at all times during the operation of ARCADIS vehicles, rental vehicles or personal vehicles used for company business.

2. PURPOSE AND SCOPEL

2.1 Purpose

2.1.1 ***Purpose Statement*** **-** ARCADIS is committed to providing a healthy and safe work environment for our employees, subcontractors, clients and visitors. To this end, ARCADIS embraces this Health and Safety (H&S) Defensive Driving Policy and Procedure.

2.1.2 ***Providing Standard Practices*** - This policy and the accompanying procedures provide standard practices with regards to defensive driving as required by employees as it relates to motor vehicle operation during the conduct of ARCADIS business.

2.2 Scope

2.2.1 ***Business Driving*** **-** This Defensive Driving policy and associated procedures apply to the operation of any motor vehicle during the conduct of ARCADIS business. It applies to every employee, temporary agency employee and contract employee operating an ARCADIS, rental or personal vehicle used for company business.

2.2.2 ***Area Involved*** **-** This policy applies to the operation of motor vehicles for company business in any country in which ARCADIS employees or temporary agency employees are working.

3. DEFINITIONS

ARCADIS Vehicle: Any vehicle owned or leased by ARCADIS.

ARCADIS Driver: Any employee, temporary agency employee, or contract employee who drives an ARCADIS vehicle, rental vehicle, or personal vehicle for business reasons whether the use of the vehicle includes operation from the local office or for travel while away from the local office.

ARCADIS Employee: Any full-time, part-time, temporary or as needed employee, and interns.

Business Use of ARCADIS, Rental, or Personal Vehicle: For the purposes of this policy, examples of business use of an ARCADIS, rental, or personal vehicle includes but is not limited to: attending meetings; driving to and from a client location; driving to dinner while out of town on business; and driving to an office supply store to pick up office supplies. Use of the vehicle for business would not include personal use as described below.

HSP: Health & Safety Procedure

MVR: Motor Vehicle Report.

Personal Use of ARCADIS Vehicle or Rental Vehicle: For the purposes of this policy, examples of personal use of an ARCADIS Vehicle or Rental Vehicle include but are not limited to: driving to dinner with a non-business-related person(s) in the vehicle; driving for the purposes of personal entertainment; using an ARCADIS Vehicle or Rental Vehicle for staying over period of time not required for business (e.g., staying over a weekend to visit friends, etc.).

Rental Vehicle: For the purposes of this policy, any motor vehicle rented from an established rental car company for ARCADIS business whether the use of the vehicle is operated from the local office or for travel while away from the local office.

Temporary Agency Employee: A temporary agency employee utilized by ARCADIS for temporary work. A temporary agency employee may become an ARCADIS employee after completing the ARCADIS employment process.

4. RESPONSIBILITIES

4.1 *Corporate H&S Department* – Have the responsibility for: Communicating the policy and procedure requirements in this HSP with all offices within ARCADIS – US. They are also responsible for ensuring that offices are aware of this HSP. They also ensure this HSP is being implemented effectively.

4.2 *Health and Safety Managers and Specialists* – Are responsible for facilitating the policy and procedure requirements in this HSP for providing “hands-on” assistance to ARCADIS staff to ensure this procedure is implemented appropriately.

4.3 *ARCADIS Managers and Supervisors (including project and task managers)* – Provide oversight management for the H&S of employees in their respective operations, and ensure that the HSP is being implemented. In addition, they assure that appropriate time is provided to facilitate the implementation of this HSP

4.4 *ARCADIS Employees* – Have the responsibilities to adhere to this HSP and to communicate H&S concerns, issues and questions to their supervisor or to Health and Safety staff. In addition, all employees have the responsibly to use the TRACK process prior to any activity and follow all ARCADIS; federal, state, provincial, and local jurisdiction regulatory; and client requirements

5. PROCEDURE

5.1 General Procedure and Requirements

ARCADIS employees, temporary agency employees, and contract employees who drive an ARCADIS vehicle, rental vehicle or personal vehicle for business will maintain a valid driver's license that is free from any driving restrictions or suspension. An ARCADIS employee, contract employee, or temporary agency employee who is asked to drive for business purposes in any type of vehicle, shall notify their supervisor or ARCADIS contact by the next business day if:

- Their license is suspended, revoked, or restricted ; and
- They receive a moving violation while driving for ARCADIS-related business.

  In the case that one of these two issues occurs, the employee's supervisor or ARCADIS contacts ARCADIS Human Resources. Human Resources, in cooperation with Corporate H&S and legal, as deemed necessary, evaluates the employee's driving status (especially in instances of license suspension, revocation or restriction) and, as appropriate, corrective action recommendations are made.

  All ARCADIS employees, temporary agency employees and contract employees driving on ARCADIS business will:

- Wear seat belts at all times;
- Operate and license the vehicle in accordance with applicable laws;
- Drive defensively as learned through training, education, and experience;
- Exercise caution when taking any prescription or over-the-counter medication that may cause drowsiness or an altered mental state;
- Have headlights on at all times, even during daylight hours;
- Do not use controlled substances, illegal drugs, or alcohol while driving on ARCADIS business;
- Do not drive in a manner that could be deemed reckless or aggressive by other drivers; and
- Do not use radar/laser-type detectors.

5.2 Comments on My Driving? Program

Along with continuing to reinforce the Smith System defensive driving techniques and the use of the LPO process, ARCADIS will be soliciting comments on our driving so that we can provide both positive feedback and develop solutions to help eliminate at-risk driving behaviors before an incident occurs using a "Comments on My Driving?" program.

The program entails the placement of a "Comments on My Driving?" bumper sticker to ARCADIS-owned and leased vehicles. The sticker contains an 866 toll-free number that the public can call to comment on our driving. The number will be checked on a daily basis by H&S. Callers will be asked to provide the ARCADIS license plate number and a description of the positive or at-risk driving behavior observed.

When a call is received, the driver's supervisor will be notified and required to discuss the call with the employee, regardless of the nature of the comment. An investigation will be initiated as follows:

- If the employee denies the actions described in the call and the investigation is inconclusive or if it is determined that the call is not legitimate, the matter will be closed. The call will be logged showing the outcome and any action taken.
- If the employee agrees or confirms the actions described, the call will be logged and:
  - The employee will be recognized commensurate with the event if it is a positive comment.
  - If the issue reported is related to at-risk behaviors, the event will be investigated per the Incident Investigation HSP (ARC HSMS010) as any other near miss would be investigated with the identification of a root cause(s) and appropriate solutions.
- The situation will also be investigated per the Incident Investigation HSP (ARC HSMS010) if an employee is the subject of multiple calls related to at-risk behaviors, even if denied.
- In addition, similar to other H&S or company policy violations, the supervisor will consult with Human Resources about other actions that may be appropriate including possible disciplinary action.

5.3 General Defensive Driving Training and Education Requirements for All Employees

All employees with an active driver's license shall complete the on-line defensive driving training course as designated by Corporate H&S or an equivalent course as approved by Corporate H&S every two years.

If a client requires classroom or hands-on drivers' training, Corporate H&S will arrange for this to be provided. The on-line training will not be required for those employees, who attend the classroom session.

Additional training may be provided or required per the request of an employee's supervisor or Corporate H&S, and as required by a client

5.4 Defensive Driving Training and Education Requirements For New Hires

Human Resources reviews the motor vehicle records (MVRs) of all new hires. If the MVR is acceptable, the new hire process proceeds as indicated below. If it is determined that the MVR is poor or borderline, the hiring manager works with Corporate H&S,

Human Resources and legal, as necessary, to determine their employment and driving status with the company.

New hires with an active driver's license shall complete the on-line defensive driving training course as designated by Corporate H&S or an equivalent course as approved by Corporate H&S within 10 days of hire. If the new hire is approved to drive for the company based on the MVR and the new hire will drive 10 days or more per year for the company business, the following process is implemented to determine additional driving requirements.

If the new hire will only drive sedan-type vehicles including sport utility vehicles (SUV) under normal on-road driving conditions, the new hire is required to:

- Complete the online training described in Section 5.3 and before they are permitted to drive on company business unless approved for limited driving by their supervisor;
- Within one month of employment complete:
  - An on-road Supervisor's Check Ride with their supervisor or designated "expert", using the Supervisor Check Ride form in Exhibit 1; or
  - A Loss Prevention Observation (LPO) with their supervisor or designated "expert" once the Loss Prevention System [LPS] is implemented at the office location; (see the LPS database for a driving LPO form)
- If the person does not successfully complete the Check Ride or LPO per the observer's and supervisor's observations and feedback, it is the hiring manager's discretion to require the successful completion of a one-day, hands-on defensive driving training course within one month of the Check Ride or LPO. It is also the manager's decision to allow the driver to continue to drive on company business until completion of the hands-on course. If approved, the person may drive on company business until the hands-on course can be scheduled and completed. If not approved, the person is not permitted to drive on company business before the hands-on course is scheduled and completed;
- Subsequent Check Rides or LPOs may be completed following the hands-on training at the discretion of the manager; and
- If the person does not successfully complete the subsequent Check Rides or LPOs, the manager reviews the situation and determines the next steps working with Human Resources as appropriate.

If the new hire will be driving vehicles that include, but not limited to, SUVs that are used in off-road field conditions, pick-up trucks, delivery trucks, utility trucks, or non-family type vans, the new hire will be required to:

- Complete the online training described in Section 5.3 and before they are permitted to drive on company business unless approved for limited driving by their supervisor;

- Within the first ten days of employment complete:
  - An on-road Supervisor's Check Ride with their supervisor or designated "expert", using the Supervisor Check Ride form in Exhibit 1; or
  - An LPO with their supervisor or designated "expert" once the LPS is implemented at the office location; (see the LPS database for a driving LPO form.)
- If person successfully completes the Check Ride or LPO per the observer's and supervisor's observations and feedback, the operations manager will make the decision as to whether the person is permitted to drive a pick-up, van, or other large vehicle prior to the completion of the hands-on training. If approved by the manager, the person may drive on company business until the hands-on course can be scheduled and completed. If not approved, the person will be permitted to drive only sedan-type vehicles and SUVs used under normal driving conditions on company business before the hands-on course is scheduled and completed. If the person does not successfully complete the Check Ride or LPO, it is the hiring manager's decision to allow the driver to continue to drive on company business until completion of the hands-on course;
- Successfully complete a one-day, hands-on training course within the first six weeks of employment with additional steps as noted below;
  - If the employee has had their license for less than one year, the supervisor plans and schedules a Check Ride or LPO within one week after the hands-on course. Supervisor may require additional Check Rides or LPOs;
  - Additional Check Rides or LPOs on all drivers may be completed following the hands-on training at the discretion of the manager; and
  - If the person does not successfully complete subsequent Check Rides or LPO, the manager will review the situation and determine the next steps working with Human Resources as appropriate.

If the new hire has a foreign license or has had their foreign license converted to a U.S. license, the new hire will be required to:

- Complete the online training described in Section 5.3 and before they are permitted to drive on company business unless approved for limited driving by their supervisor;
- Successfully complete a one-day, hands-on training course within the first six weeks of employment with additional steps as noted below;
  - If the employee has had their license for less than one year, the supervisor plans and schedules a Check Ride or LPO within one week after the hands-on course. Supervisor may require additional Check Rides or LPOs;

- Additional Check Rides or LPOs on all drivers may be completed following the hands-on training at the discretion of the manager; and
- If the person does not successfully complete subsequent Check Rides or LPO, the manager will review the situation and determine the next steps working with Human Resources as appropriate.

Refer to the flowchart in Exhibit A for the decision-making process for new hires.

5.5 Additional Defensive Driving Training and Education Requirements for Existing Employees

In addition to the training as required in Section 5.3, existing employees complete hands-on defensive driving training at the discretion of their supervisor or manager based on one of two conditions.

- If a manager or supervisor determines that the driving hazards faced by the employee require hands-on training to assist in the prevention of motor vehicle accidents.
- If the results of an LPO or Check Ride conducted by a supervisor or manager indicate that the employee requires additional training.

5.6 Additional Defensive Driving Training and Education Requirements for Employees Involved in a Motor Vehicle Accident

Any ARCADIS employee involved in a motor vehicle accident while driving on company business, may be required to complete hands-on defensive training. This training may be repeated as often as necessary based on the manager's discretion in cooperation with Corporate H&S and Human Resources.

Additional training may not be provided if it is determined by the supervisor in cooperation, as necessary from HR, legal, and/or Corporate H&S, that the employee will no longer be permitted to drive on company business.

5.7 Sources for On-Line and Hands-On Defensive Driving Training

The on-line defensive driving training or equivalent training is provided by, or based on, a nationally recognized defensive driving training company such as the Smith System, National Safety Council, or other recognized provider as approved by Corporate H&S.

Hands-on defensive driving training is provided by, or based on, a nationally recognized defensive driving training provided such as the Smith System, National Safety Council or provider approved by Corporate H&S. The trainer must be certified in the program upon which they are instructing and can be either internal or external to ARCADIS.

5.8 Additional Training and Education for Other Driving Conditions

Supervisors, managers, or H&S staff determines additional training for employees driving under special conditions such as towing trailers, riding and operating all-terrain vehicles (ATVs) or other non-routine driving conditions. Training is coordinated and approved by Corporate H&S and the ARCADIS training department.

5.9 Driving Distractions and Cell Phone Use While Operating a Motor Vehicle

ARCADIS drivers avoid distractions while they operate motor vehicles and the vehicle is moving. These distractions include such things as eating, drinking, reading maps or other information, operating the radio, and using cell phones. Specific requirements regarding cell phones are as follows:

- The safest driving occurs when drivers can focus their full attention on operating the vehicle and the surrounding conditions. To minimize driving distractions, any use of cell phones by ARCADIS employees while operating a motor vehicle is not recommended and highly discouraged. It is expected that all ARCADIS drivers will use the TRACK process to assist in assessing the safety of using a cell phone while driving.

- Using a cell phone or Blackberry for sending/reading text messages, or reading, preparing or sending emails is strictly prohibited while driving.

- The ARCADIS Vehicle Use Policy provides the ARCADIS policy on the use of cell phones while operating a motor vehicle. The policy should be reviewed for employees' guidance and the minimum precautions to use to advance the safe use of cell phones while driving. In summary, this policy allows cell phone use only where it is not banned by a client or regulatory requirement, and only if it is hands free. This policy can be reviewed in the Employee Handbook on the Human Resources intranet page.

- Supervisors and managers are permitted to apply more stringent requirements regarding cell phone use (i.e., no cell phone use at all while driving) based on client, business, or regulatory requirements.

5.10 Additional Required Defensive Driving Procedures

ARCADIS requires additional defensive driving techniques to assist in the elimination or minimization of motor vehicle accidents. These required techniques include:

- When a second ARCADIS employee is available, and where it is safe to do so, all vehicle backing operations will require the use of a spotter to assist with the backing operation.
- To assist drivers in their potential lack of familiarity with the location in which they are driving, one of the following will be utilized by drivers traveling to unfamiliar locations:
  - The use of GPS systems in rental cars such as Hertz Never Lost
  - Pre-Trip Route Planning through the use of Google Maps or MapQuest

- Development and use of a Journey Management Plan (this is required by some clients).

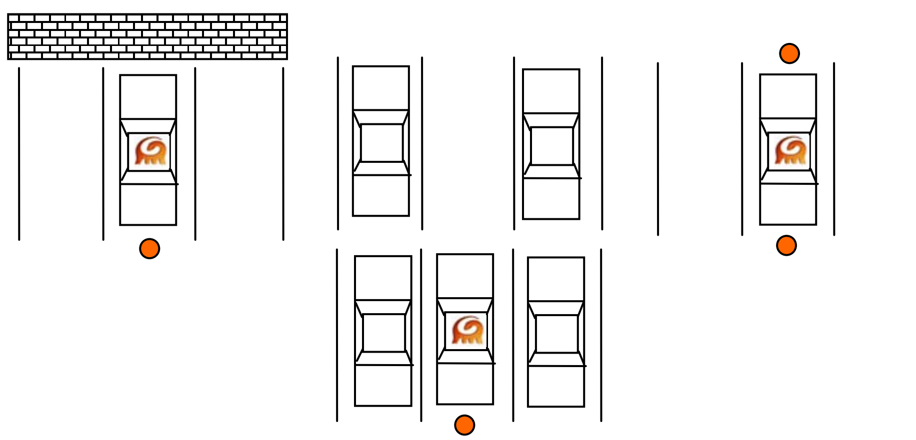
5.11 Cone Placement and Retrieval to Encourage Visual Inspection Around Vehicle

To ensure that the area around a parked vehicle is clear of obstacles, all company owned or leased trucks will be equipped with two to four traffic cones that will be placed around the vehicle whenever the driver leaves the vehicle unattended (when the vehicle is parked and the occupants are outside of the vehicle regardless of distance or visual site); the cones will be placed in the configurations shown on the following page. Upon departing in the vehicle, the driver will pick up the cones and look around the vehicle before moving.

Employees will use TRACK and place cones around vehicles in a manner that promotes driver awareness of vehicle surroundings and is appropriate to conditions encountered. The following general guidelines will help facilitate adherence to this program.

Parking Lots:

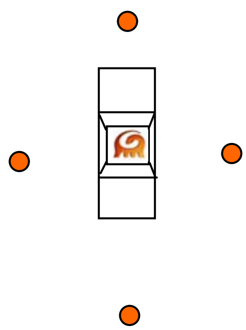
- At a minimum, one cone will be placed at the end of the vehicle in the direction of movement from the parking place when only one direction can be driven (Example 1).
- Parking lots with facing parking spaces, only deploy cone on the roadway end of vehicle (Example 2).
- Two cones will be required (one at each end of the vehicle) if potential movement can be from a forward or backing direction (Example 3)



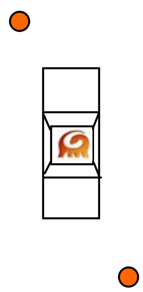
Example 1 | Example 2 | Example 3

Project Sites:

- It is recommended that one cone be placed on all four sides of the parked vehicle at a distance sufficient to prevent trip hazards during the course of normal work around the vehicle (Example 4). If only two cones are available, the placement of the cones should be as shown in Example 5.



Example 4



Example 5

- Cone placement is not required for cars used for non- field work purposes.

- Use TRACK for all cone placement activities:

  - DO NOT place cones in parking lots in a manner that could cause a trip hazard to employees or the public.

  - DO NOT place cones in a manner that would affect or impede the flow of traffic, unless part of a traffic control program.

Offices and/or Projects should consider the purchase of exterior cone stands (mount on the vehicle bumper) for easy cone access when complying with this program. Cones should be orange color and have a minimum height of 18 inches. These cones may be procured from existing office stock or are available for purchase on the ARCADIS Section of the Wise Safety and Environmental website.

6. REFERENCES

- ARCADIS HSP - ARC HSMS011 – Incident Reporting and Investigation

- ARCADIS HSP - ARC HSMS015 – Root Cause Analysis and Solutions Development

- ARCADIS HSP - ARC HSMS006 – Health and Safety Training and Competence
- ARCADIS Vehicle Safety Policy, Employee Handbook

7. RECORDS

- Training Records for completion of training
- Completed LPOs or Check Ride forms
- Completed Incident investigations and root cause analyses

8. APPROVALS AND HISTORY OF CHANGE

Mija A. Coppola

Approved By: Mija A. Coppola, Director, H&S Compliance Assurance and LPS

History of Change

Revision Date	Revision Number	Reason for change
26 March 2007	01	Original document
18 August 2007	02	Change in required on-line defensive drivers training
22 October 2007	03	Changing over to new template format and addition of the “Comments on My Driving?” program
21 January 2008	04	Change to new template; change to 2008 organization job titles; change to prohibit texting/emailing while driving
13 June 2008	05	Addition of Sections 5.10 and 5.11 on other defensive driving techniques and cone placement.
6 October 2008	06	Clarified who is required to complete online training in Section 5.3 and modified section on when hands-on defensive driving is required after an accident.

Exhibit 1 – Defensive Driving Training and Education for New Hires

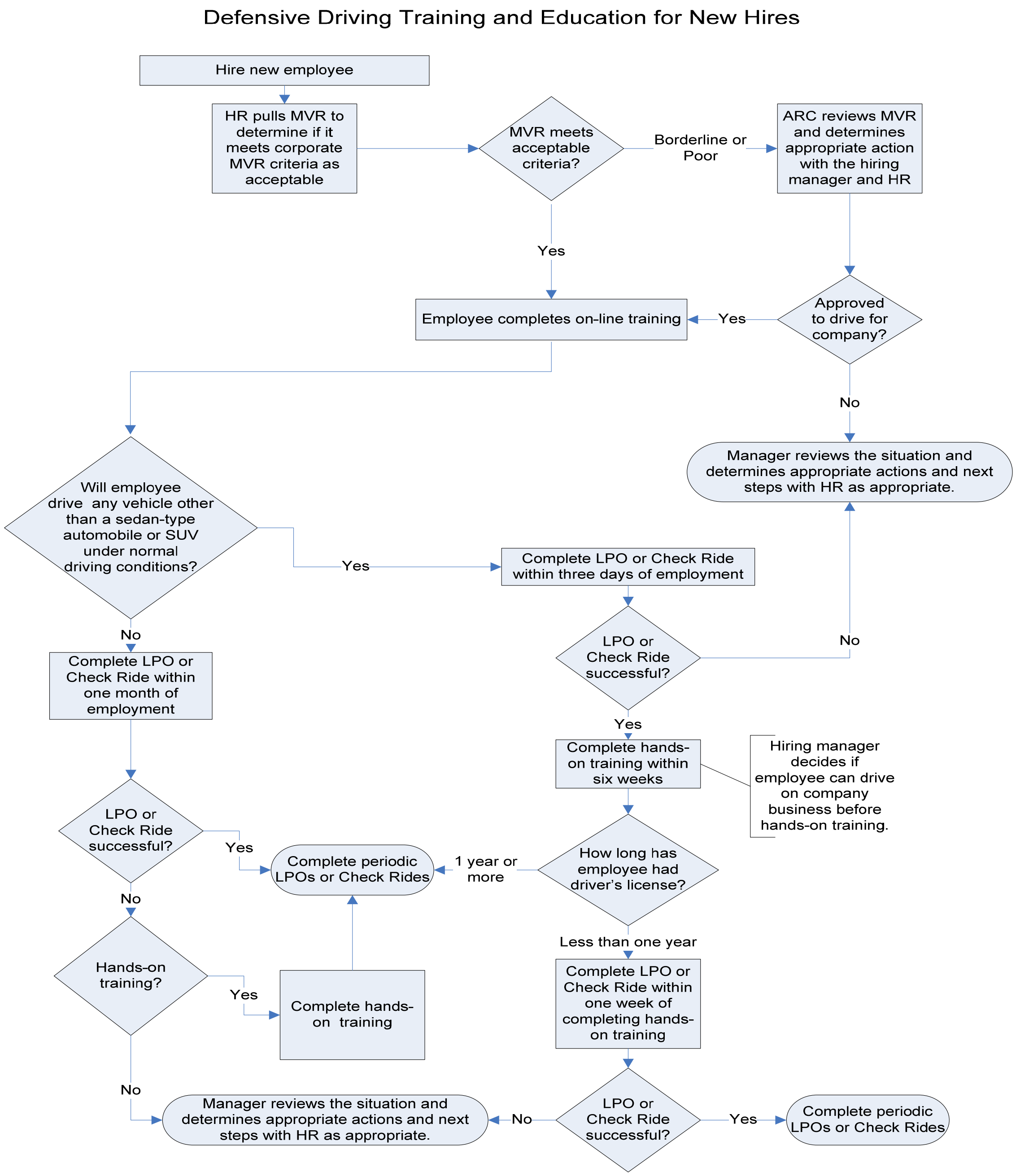


Exhibit 2 – Supervisor's Check-Ride Checklist

Driver's Name ____________________________Supervisor's Name ______________________________

Date & Time _______ Type of Vehicle _______ Check-ride Number _____ In a Series of _____

	Yes	No	N/A
1. Uses Seatbelt?	☐	☐	☐
2. Drives within speed limit?	☐	☐	☐
3. Maintains proper speed for conditions?	☐	☐	☐
4. Uses "farsighted" seeing skills to prevent last minute surprises?	☐	☐	☐
5. Drives in lane offering least hazards?	☐	☐	☐
6. Maintains adequate space cushion while driving?	☐	☐	☐
7. Keeps eyes moving continuously?	☐	☐	☐
8. Takes in whole picture by utilizing mirrors frequently?	☐	☐	☐
9. Approaches intersections defensively with foot over brake pedal?	☐	☐	☐
10. Slows down gradually when approaching red lights and stop signs?	☐	☐	☐
11. Looks both ways prior to entering an intersection?	☐	☐	☐
12. Recognizes and reacts appropriately to blind intersections?	☐	☐	☐
13. Stops for amber lights whenever possible?	☐	☐	☐
14. Looks both ways before starting up on a green light?	☐	☐	☐
15. Make full stop at all stop signs?	☐	☐	☐
16. Uses turn signals for all turns and lane changes?	☐	☐	☐
17. Turns into proper lane when making a turn?	☐	☐	☐
18. Communicates effectively and properly with horn and/or signal lights?	☐	☐	☐
19. If nighttime, uses bright lights appropriately?	☐	☐	☐
20. Blends smoothly with merging traffic?	☐	☐	☐
21. Keeps both hands on steering wheel?	☐	☐	☐
22. Allows adequate space cushion when stopped behind other vehicles?	☐	☐	☐
23. Walks around vehicle prior to backing to check for obstacles?	☐	☐	☐
24. Checks all clearances?	☐	☐	☐
25. Backs slowly?	☐	☐	☐
26. Responds appropriately to make way for emergency vehicles?	☐	☐	☐

Note any corrective action taken or other comments: ____________________________________
____
____

Supervisor's Signature ________________________**Job Title** ______________________________

Benzene

1. Policy

ARCADIS understands the hazards of personal exposure to benzene. Based on this understanding, ARCADIS will implement the appropriate controls to minimize or eliminate the hazards of benzene. These controls will focus first on engineering controls to mitigate benzene hazards where appropriate and practical. Administrative controls may also be implemented as appropriate and practical. Where it is not appropriate or practical to implement engineering and administrative controls, personal protective equipment (PPE) will be implemented to control benzene hazards below known occupational exposure limits.

2. Purpose and Scope

2.1 Purpose

2.1.1 Benzene Exposure Protection **-** This policy and associated procedures provides information to protect ARCADIS employees, subcontractors, and other effected personnel from exposures to benzene while conducting work on ARCADIS projects.

2.1.2 OSHA Requirements – This policy meets the requirements of the U.S. Occupational Safety and Health Administration (OSHA) regulations including Title 29 Code of Federal Regulations (CFR) Part 1910.1028.

2.2 Scope

This policy and the associated procedures apply to all projects where benzene is known or thought to be present, and where ARCADIS employees, subcontractors and other effected personnel are or could be exposed to benzene above the Action Level**.**

3. Definitions

Benzene—is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

Benzene is encountered on ARCADIS projects, frequently, as a contaminant in soils, ground and surface water, sediments, and other environmental media. Personnel may also encounter benzene in other forms at certain client facilities at which ARCADIS works. It can be encountered at petroleum-related facilities, chemical production facilities and other types of industrial sites.

Action Level—the airborne concentration established by OSHA that triggers certain regulatory requirements.

HSP—Health and Safety Procedure

Permissible Exposure Limit (PEL)—an average airborne concentration regulatory limit established by OSHA above which requires control to protect people from adverse health effects.

Short Term Exposure Limit (STEL)—a PEL or TLV established as a limit of exposure measured over a designated period of time less than 8 hours.

Threshold Limit Value (TLV)—a recommended average airborne concentration limit established by ACGIH. The TLVs are reviewed and updated as appropriate annually.

Time Weighted Average (TWA)—a measurement of airborne exposure to a chemical compound measured and averaged over a designated period of time for comparison to an STEL or an 8-hour PEL or TLV.

4. Responsibilities

4.1 Principal-In-Charge, Project and Task Managers are responsible, as part of the project hazard assessment, for determining if benzene is or is potentially present on a project site. In addition, the project or task manager is responsible for determining client requirements with respect to the control of benzene hazards. Project and Task Managers notify health and safety staff when working on sites containing benzene. Project and Task Managers are also responsible for ensuring that project staff has the appropriate and applicable training for benzene prior to those staff beginning work.

4.2 Corporate Health and Safety is responsible for keeping this policy and procedure up-to-date with current regulatory requirements and best practices. In addition, Corporate Health and Safety oversees the medical surveillance program for benzene, as applicable and provides a benzene training package for presentation to appropriate staff.

4.3 Project Health and Safety Staff including designated Writers and Reviewers of Project Health and Safety Plans (HASPs) are responsible for developing control processes and techniques on specific projects based on the levels of benzene expected to be encountered on project facilities.

4.4 Project Personnel are responsible for completing benzene training as required by this policy and procedure, and for following all hazard control processes designated by the Project Manager, Project Health and Safety Staff, and the project HASP. If project personnel believe that benzene is present that was not previously identified or is at levels that are higher than expected, they should stop work and notify project health and safety staff or the project manager immediately and not proceed until authorized.

5. Procedure

5.1 Benzene Hazards

- Benzene is primarily an inhalation hazard. Benzene vapor does not present an appreciable skin hazard; benzene liquid is absorbed through the skin.
- The acute (short term) effects of inhalation exposure are similar to most other hydrocarbons (narcosis, dizziness, weakness, headache, nausea).
- Prolonged or repeated exposure to concentrations above the permissible exposure limits may lead to blood disorders, including anemia, leucopenia (low white blood cell counts), and leukemia (cancer of the blood system).

- As with most hydrocarbons, repeated/prolonged skin exposure to liquid may lead to the aforementioned disease(s) of the blood.

5.2 Exposure Limits and Regulated Areas

The following personal exposure limits are established for benzene by inhalation:

- OSHA ACTION LEVEL – 0.5 ppm benzene in air 8-hour TWA.
- OSHA PELs
  - TWA - 1.0 part per million (ppm) benzene in air averaged over an 8 hour period.
  - STEL - 5.0 ppm benzene in air averaged over any 15 minute period.
- ACGIH TLVs
  - TWA – 0.5 ppm benzene in air averaged over an 8 hour period
  - STEL – 2.5 ppm benzene in air averaged over an 8 hour period
  - Skin notation – meaning that there is a significant contribution to overall exposure by the cutaneous route including mucous membranes and the eyes, and by contact with vapors, liquids and solids containing benzene.
- Personal exposure is the concentration of benzene to which a person would be exposed if that person were not wearing respiratory protection. Personal exposures shall be measured over the exposure period in the breathing zone of the employee. Personal exposures should not be determined by area sampling.
- REGULATED AREA
  - An area where the benzene exposure does or can be expected to exceed the PELs or TLVs. Since it may be difficult to determine the exposure time for employees working in areas with concentrations that exceed PEL or TLV values, the facility/location may wish to regulate any area that exceeds 0.5 ppm or per the requirements of the client or of the project HASP.
  - The PEL for benzene is relatively low as compared to the PEL or TLV of other hydrocarbons such as gasoline (300 ppm); therefore, depending on exposure conditions, it may be very “easy” to exceed the PEL or TLV for benzene even though other hydrocarbon levels are not considered very high. Also of concern is historic monitoring data that indicates that short term work activities such as draining a cargo hose of gasoline or pumping free product from an aquifer may result in a benzene exposure exceeding the STEL.

5.3 Actions for Employee Exposures Greater Than or Equal to the OSHA Action Level or ACGIH TLV – TWA but Less than the OSHA PEL - TWA

- Training: Annual benzene training is required.

- Respiratory Protection: full-face air purifying respirators equipped with organic vapor cartridges will be used per the project HASP.

- Medical Surveillance: Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the Action Level on at least 30 calendar days during the coming year.

- Periodic Monitoring - shall be conducted at least annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the Action Level.

5.4 Actions for Employee Exposures Greater Than PELs

- Respiratory Protection: respirators shall be used in all regulated areas.

- Training: Annual benzene training is required.

- Medical Surveillance: Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the PEL on a least 10 calendar days during the coming year.

- Written Program: A written program to reduce personal exposure is required detailing the methods to be used to reduce exposures below the TLVs and the OSHA Action Level. These written programs will be in the form of the project HASP based on project-specific and client requirements. The HASP will indicate the schedule for the implementation of the any benzene-related hazard control processes or methods. The HASP is reviewed periodically per the ARCADIS HSP ARC HSFS010 – Health and Safety Plans. All project personnel have access to the project HASP at all times.

- Periodic Monitoring - at least every 6 months until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL; then annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL Action Level.

5.5 Exposure Monitoring

- Representative personal exposure monitoring is required for each type of operation involving the handling of or potential exposure to benzene.

- Personal exposure monitoring shall utilize standard industrial hygiene sampling techniques and recordkeeping.

- Passive badges such as the 3M 3500 or charcoal tube sampling may be used for this sampling activity.
- Detection tubes shall not be used for compliance personal exposure determination but may be used for work and confined space entry permitting and defining regulated areas.
- Employees who have been monitored for benzene exposure shall be notified of the monitoring results within 15 working days of receipt of these results. If the PEL is exceeded, the notification must indicate the follow-up plans or corrective actions to be taken to reduce exposures to below the PEL.

- Personal STEL monitoring should be used to characterize exposures for specific tasks such as gauging, O&M of treatment equipment, hose connect and disconnect, maintenance tasks such as flange breaking, etc.

- Personal TWA monitoring can be used for extended tasks, such as well developing and sampling, loading, tasks inside vessel holds, tank cleaning, and maintenance tasks such as pump removal, etc.

- Area sampling can be used to determine regulated areas; the sampling media shall determine the duration of sampling:

  - Detection tubes (Kitagawa #118SB, or Draeger 0.5/c) can be used for real-time determination.
  - Charcoal tube samples must be taken for at least 15 minutes (passive badges are not recommended for area sampling).

- Periodic Monitoring is required if exposures exceed the Action Level or PELs.

5.6 Requirements for Regulated Areas

- Posting: Regulated areas shall be indicated such as by barricades, barricade tape, painted demarcations, or other devices.

- A sign shall be posted at the access to the regulated area with the warning:

1. DANGER
2. BENZENE
3. CANCER HAZARD
4. FLAMMABLE - NO SMOKING
5. AUTHORIZED PERSONNEL ONLY

[Minimum lettering height: DANGER BENZENE 4"; others 3"]

- Respiratory Protection: Respirators shall be worn by all personnel when in a regulated area, regardless of the time period or over-all personal exposure measurement.

- Labeling
  - In addition to appropriate Hazard Communication labeling, containers or equipment containing > 0.1% benzene must also be labeled as such:

DANGER
CONTAINS BENZENE
CANCER CAUSING AGENT

  - Pipelines do not need to be labeled.

5.7 Exposure Reduction

- Written Program
  - The Project Manager and the Project Health and Safety Staff will develop a written program for exposure reduction if there is a determination that employee exposures may exceed the PELs or TLVs.
  - The written program must list the corrective actions that will be taken to reduce employee exposure to at or below the PELs and TLVs:
    - identify regulated areas/tasks;
    - engineering controls;
    - revised work practices;
    - respiratory protection and protective clothing; and
    - schedule of development and implementation.

- Spills and Emergencies

An emergency is any occurrence which may result in an unexpected significant release of benzene that may result in a significant inhalation or skin exposure. After an emergency, appropriate monitoring must be conducted to assure the ambient benzene levels are back to normal; and conduct appropriate medical surveillance for affected employee(s).

- Respiratory Protection and Personal Protective Equipment

  - Respirators shall be worn, maintained and managed in accordance with the OSHA standard, 29 CFR 1910.134 and ARCADIS HSP ARC HSGE017 – Respiratory Protection. In addition, any client requirements on project sites will be followed.
  - Per the project HASP, respiratory protection will be worn at all times when airborne concentrations of benzene exceed the OSHA Action Level or the ACGIH TLV-TWA. The respirator will be a full-face air purifying respirator equipped with organic vapor cartridges. Action limits for upgrading to a higher level of protection will be documented in the project HASP or per client requirements.
  - Appropriate eye protection will be worn as necessary. Protective clothing and gloves suitable for the particular product (such as for gasoline) will generally be suitable for protection against the benzene in that product. For most hydrocarbon products, nitrile gloves, provide adequate protection. Chemical resistant clothing may vary depending on the product and degree of exposure.
  - For “pure” benzene the following materials are recommended:
    - gloves: poly-vinyl alcohol (PVA)
    - clothing: Saranex or Barricade (DuPont) or equivalent.

5.8 Medical Surveillance

- Initial medical surveillance is required:

  - If employee personal exposures are reasonably expected to exceed the Action Level on at least 30 calendar days per year; or
  - If employee personal exposures are reasonably expected to exceed the PEL on a least 10 calendar days per year.

- Periodic exams are required on an annual basis for employees who continue to meet the criteria listed above. Annual exams may be discontinued after the exam conducted the year after personal exposures fall below the limits stated above in this section.

- The specific medical exam requirements are explained in detail in ARCADIS HSP ARC HSGE010 - Medical Surveillance.

- The physician must be supplied a copy of the OSHA benzene regulation 29 CFR 1910.1028 and a description of the employee’s benzene exposure.

- For employees exposed to benzene from an emergency, a urine sample must be taken at the end of the shift. A urinary phenol test must be performed on the sample within 72 hours.

- OSHA regulations for benzene have specific medical removal provisions for medical examinations results falling outside of certain criteria. The facility/location should contact the Corporate Health and Safety Manager if the examining physician indicates that an employee may fall into these criteria.

5.9 Training

- Initial benzene training is required for all employees assigned to a work area suspected or known to contain benzene.

- Annual benzene training is required for all employees actually or potentially exposed to greater than the Action Level (TWA > 0.5 ppm).

- Initial and annual training shall consist of:

  – The operations that involve benzene exposure.
  – The methods/observations that can be used to detect the presence or release of benzene
  – The physical and health hazards of benzene.
  – Methods used to protect against the hazards of benzene.
  – The proper use of personal protective equipment in emergency situations.
  – The meaning of a regulated area and how such are demarcated.
  – A review of the applicable standard and where copies can be found.
  – An explanation of the medical surveillance program

6. References

- OSHA 29 CFR 1910.1128 Benzene

- ACGIH 2006 TLVs and BEIs – Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices

- ARCADIS Medical Surveillance HSP – ARC HSGE006

7. Records

- All exposure, medical, and training records shall be kept for 30 years.

- All exposure and medical records shall be made available to appropriate regulatory agencies upon written request.

- Employees who have been monitored for benzene exposure shall be notified of the monitoring results within 15 working days of receipt of these results; a written request is not required

8. Approvals and History of Change

Approved By: Mija Coppola, Director H&S Compliance Assurance and LPS

History of Change

Revision Date	Revision Number	Reason for change
26 March 2007	01	Original document
7 June 2007	02	Change to new template
6 September 2007	03	Changing over to new template format
22 February 2008	04	Template change

ARCADIS

Appendix F

MSDSs

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Benzene
MSDS 316
BEN2200

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Benzene **CAS Number:** 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
Synonyms: (6)ANNULENE; BENZEEN; BENZEN; BENZENE; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

OSHA PEL
TWA: 1 ppm; 3 mg/m^3; STEL: 5 ppm; 15 mg/m^3; from Table Z-2.

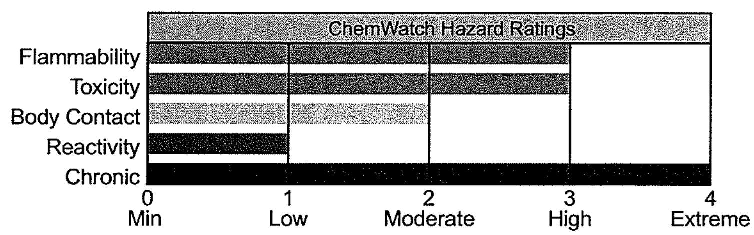
ACGIH TLV
TWA: 10 ppm; 32 mg/m^3.

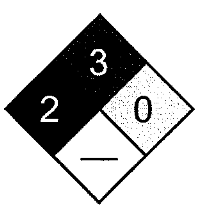
NIOSH REL
TWA: 0.1 ppm. STEL: 1 ppm.

IDLH Level
500 ppm.

Section 3 - Hazards Identification

HMIS
3 Health
3 Flammability
0 Reactivity





Fire Diamond

ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Also causes: headache, dizziness, drowsiness. Absorbed through the skin. Chronic: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Primary Entry Routes: inhalation, skin contact
Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation hazard is increased at higher temperatures.

The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.

Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.

Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.

Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.

Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.

Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.

Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.

Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

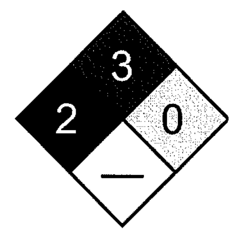
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.
Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% v/v
UEL: 7.1% v/v



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Pollutant - contain spillage. Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.
Personal Protective Clothing/Equipment
Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Note: must change cartridge at beginning of each shift
Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.
Glove Selection Index:

PE/EVAL/PE	A
PVA	A
TEFLON	A
VITON	A
VITON/NEOPRENE	A
NITRILE+PVC	C

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

BUTYL C
NITRILE C
NEOPRENE C
PVC C
NATURAL RUBBER C
BUTYL/NEOPRENE C

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Water Solubility: 0.18 g/100 g of water at 25 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 80.1 °C (176 °F)
Freezing/Melting Point Range: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

IRRITATION
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See NIOSH, *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3×10^{-3}

BCF: eels 3.5

Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days

Octanol/Water Partition Coefficient: $\log K_{OW} = 2.13$

Soil Sorption Partition Coefficient: K_{OC} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: BENZENE
Hazard Class: 3.1
ID No.: 1114
Packing Group: II
Label: Flammable Liquid[3]

Additional Shipping Information:

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U019 Toxic Waste; Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4); per RCRA Section 3001; per CWA Section 307(a); per CAA Section 112 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date:............................1999-11 **Review Date:** 2000-07

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Issue Date: 2003-02

Section 1 - Chemical Product and Company Identification

Material Name: Benzo(a)pyrene **CAS Number:** 50-32-8
Chemical Formula: $C_{20}H_{12}$
EINECS Number: 200-028-5
Synonyms: B(A)P; BAP; BENZO(D,E,F)CHRYSENE; 3,4-BENZOPIRENE; 1,2-BENZOPYRENE; 3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(A)PYRENE; 3,4-BENZPYREN; 3,4-BENZ(A)PYRENE; 3,4-BENZPYRENE; BENZ(A)PYRENE; BENZ[A]PYRENE; 3,4-BENZYLPYRENE; 3,4-BENZYPYRENE; 3,4-BP; BP; COAL TAR PITCH VOLATILES: BENZO(A)PYRENE
Derivation: Synthesized from pyrene and succinic anhydride.
General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo(a)pyrene	50-32-8	ca 100% wt

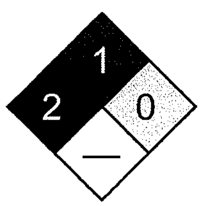
Except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PEL
TWA: 0.2 mg/m^3.

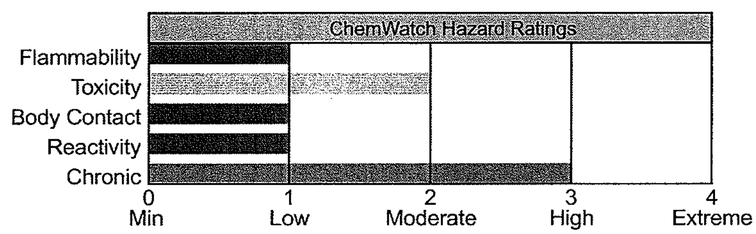
NIOSH REL
No data found.

ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond



HMIS
2 Health
1 Flammability
0 Reactivity

ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Benzo(a)pyrene is a pale yellow, crystalline solid or powder that is irritating to the skin, eyes, and respiratory tract. It is a carcinogen and mutagen. Handle with extreme caution!

Potential Health Effects

Target Organs: Respiratory system, bladder, kidneys, skin.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects
Inhalation: Respiratory tract irritation. Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).
Eye: Irritation and/or burns on contact.

Skin: Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization).

Ingestion: None reported.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.

Chronic Effects: Inhalation: Cough and bronchitis. Eye: Photosensitivity and irritation. Skin: Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization). Other: Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.

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

Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.

Special Precautions/Procedures: Emergency personnel should protect against exposure.

Section 5 - Fire-Fighting Measures

Flash Point: None reported. Benzo(a)pyrene may burn, but does *not* readily ignite.

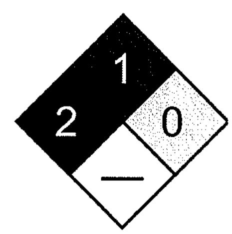
Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.

General Fire Hazards/Hazardous Combustion Products: Carbon monoxide and carbon dioxide.



Fire Diamond

Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.

Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.

Large Spills: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways. *Do not* dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. *Do not* reuse contaminated cleaning materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.
Recommended Storage Methods: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.
Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV1, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semiannual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.
Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.
Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure- demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.
Other: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Pale yellow monoclinic needles with a faint, aromatic odor.
Physical State: Solid
Vapor Pressure (kPa): >1 mm Hg at 68 °F (20 °C)
Formula Weight: 252.30
Specific Gravity (H_2O=1, at 4 °C): 1.351
Boiling Point: >680 °F (>360 °C); 540 °F (310 °C) at 10 mm Hg
Freezing/Melting Point: 354 °F (179 °C)
Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)
Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone. Hazardous polymerization cannot occur. Avoid heat and ignition sources and incompatibles.

Storage Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Irritation Effects:

Mouse: 14 µg caused mild irritation.

Other Effects:

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Tumorgenicity, mouse, oral: 75 mg/kg administered to the female during the 12- 14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Mouse, inhalation: 200 ng/m^3/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

Human, lung cell: 1 µmol/L caused DNA damage.

Human, liver cell: 100 nmol/L caused DNA damage.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

See NIOSH, *RTECS* DJ3675000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr). It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils. It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.

Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.

BCF: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp*), snails (*Litternia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.

Octanol/Water Partition Coefficient: log $K_{ow} = 6.04$

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Environmentally hazardous substances, solid, n.o.s.*
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9

Additional Shipping Information: * If it is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) of 1 lb (0.454 kg).

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U022 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1 lb (0.454 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Coal Tar Creosote
COA9000

Issue Date: 2003-02

Section 1 - Chemical Product and Company Identification

Material Name: Coal Tar Creosote **CAS Number:** 8001-58-9
Chemical Formula: No data found.
EINECS Number: 232-287-5
Synonyms: AWPA #1; BRICK OIL; COAL TAR CREOSOTE; COAL TAR CRESOTE; COAL TAR OIL; CREOSOTE; CREOSOTE OIL; CREOSOTE P1; CREOSOTE,FROM COAL TAR; CREOSOTUM; CRESYLIC CREOSOTE; DEAD OIL; EPA PESTICIDE CHEMICAL CODE 025004; HEAVY OIL; HODGSONS CREOSOTE; LIQUID PITCH OIL; NAPHTHALENE OIL; PRESERV-O-SOTE; SAKRESOTE 100; TAR OIL; WASH OIL
Derivation: By distillation of coal tar produced by high-temperature carbonization of bituminous coal; by mixing strained naphthalene oil, wash oil, and strained or light anthracene oil; as a by-product of conventional coal coking.
General Use: Used mainly as a wood preservative for railroad ties, poles, fence posts, marine pilings, and other lumber for outdoor use; as a water-proofing agent, fuel oil constituent, frothing agent for mineral separation, tap hole refractory cement, and lubricant for die molds. Used only in limited quantities as an animal and bird repellent, animal dip, and insecticide (ovicide).

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Coal tar creosote	8001-58-9	Consists of aromatic hydrocarbons,

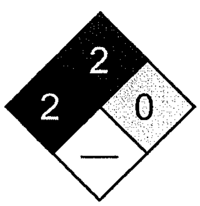
anthracene, naphthalene, and phenanthrene derivatives; some tar acids; and tar bases. Polycylic aromatic hydrocarbons make up at least 75%. * Creosote contains several carcinogenic polycyclic aromatic hydrocarbons including benz[a]anthracene, benzo[a]pyrene, and dibenz[a,h]anthracene.

OSHA PEL
No data found.

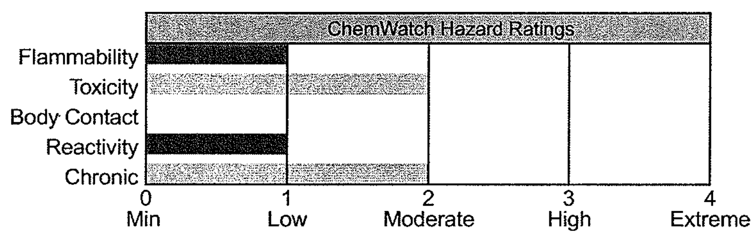
NIOSH REL
No data found.

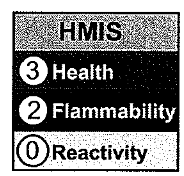
ACGIH TLV
No data found.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Coal tar creosote is a colorless (pure) or yellow to black (industrial) liquid with an aromatic smoky smell. It is irritating to the eyes, skin and respiratory tract and can be corrosive, causing severe burns. Coal tar creosote is a probable human carcinogen. It is a combustible liquid that is a moderate fire hazard when exposed to an ignition source.

Potential Health Effects

Target Organs: Eyes, skin, bladder, kidneys, and respiratory system
Primary Entry Routes: Inhalation, skin absorption, and skin and/or eye contact
Acute Effects *Note! Phenol and phenolic derivatives of various aromatic hydrocarbons (tar acids), present in low concentrations, are the constituents most likely to be responsible for acute toxicity.*
Inhalation: Inhalation of vapors causes moderate irritation to the nose, throat, and upper respiratory tract.
Eye: Contact with liquid causes conjunctivitis (inflammation of the eye's lining), keratitis (corneal inflammation), or corneal burns with scarring. May cause loss of vision.

Skin: Contact causes irritation, burning, itching, redness, pigment changes, dermatitis (a rash of redness and bumps), or burns. Photosensitization (worsening of rash with exposure to sunlight) may occur.

Ingestion: Causes salivation, nausea; vomiting; gastrointestinal tract irritation or bleeding; abdominal pain; rapid, thready pulse; vertigo; headaches; loss of pupillary reflexes; hypothermia; cyanosis; respiratory distress; shock and mild convulsions. Large doses may be fatal.

Carcinogenicity: NTP - Not listed; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B1, Probable human carcinogen based on epidemiologic studies; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Skin disorders.

Chronic Effects: Include dermatitis and, possibly, skin cancer or other forms of cancer. An increased risk of scrotal cancer for creosote-exposed brick makers was indicated in a worker mortality analysis. Epidemiological studies of coke oven workers reveal increased incidences of lung, bladder, prostate, pancreas, and intestinal cancer.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air, monitor for respiratory distress, and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician or ophthalmologist immediately.

Skin Contact: *Quickly* remove contaminated clothing. Prior to washing and if readily available, use undiluted polyethylene glycol 300 to 400. Wash affected area with soap and flooding amounts of water for at least 15 min. *Do not* rub or apply pressure to the affected skin, apply any oily substance or use hot water to rinse. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Rinse the mouth several times with cold water. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not induce vomiting!* Keep victim warm and at rest.

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

Note to Physicians: Creosote may be detected in urine.

Special Precautions/Procedures: An exposed person should examine their skin periodically for growths, changes in warts or moles, and sores that do not heal.

Section 5 - Fire-Fighting Measures

Flash Point: 165.2 °F (74 °C), Closed Cup

Autoignition Temperature: 637 °F (336 °C)

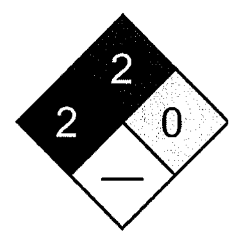
LEL: None reported.

UEL: None reported.

Flammability Classification: OSHA IIIA combustible liquid

Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or regular foam. For large fires, use water spray, fog or regular foam.

General Fire Hazards/Hazardous Combustion Products: Include carbon oxides. Coal tar creosote may present a vapor explosion hazard indoors, outdoors, and in sewers. Vapors may travel to an ignition source and flash back.



Fire Diamond

Fire-Fighting Instructions: If feasible and without undue risk, remove containers from fire hazard area. Otherwise use water spray to cool fire-exposed containers until well after they are extinguished. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Also, wear full protective clothing. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Immediately leave area if you hear a rising sound from venting safety device or notice any fire-caused tank discoloration as a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Isolate area for 1/2 mile in all directions if fire involves tank, rail car or tank truck. Fully decontaminate or properly dispose of personal protective clothing.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel. Isolate hazard area, deny entry, and stay upwind of spills. Shut off all ignition sources. Cleanup personnel should protect against vapor inhalation and skin and eye contact.

Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal.

Large Spills: Consider initial downwind evacuation for at least 300 meters (1000 feet). For large spills, dike far ahead of liquid spill for later disposal. Water spray may reduce vapor. *Do not* release into sewers or waterways. Use nonsparking tools during clean-up.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation and skin and eye contact. Use ventilation sufficient to reduce airborne exposures to nonhazardous levels (Sec. 2). Wear protective gloves, goggles, and clothing to avoid contact. Wear respiratory protection when necessary (Sec. 8). Consult your industrial hygienist. Practice good personal hygiene procedures to avoid inadvertently ingesting this material. Keep away from ignition sources.
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat and ignition sources. Store coal tar creosote as close to area of use as possible to minimize transporting distance. Avoid physical damage to containers.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose all operations and/or ventilate at the site of release to avoid vapor dispersion into the work area. To prevent static sparks, electrically ground and bond all containers and equipment. Provide general or local exhaust ventilation systems equipped with high-efficiency particulate filters to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Preplacement and periodic medical examinations of exposed workers emphasizing respiratory, skin, liver, and kidney disorders, including comprehensive work and medical history, physical examination, CXR, PFTs, urinalysis, LFT, and sputum cytology as the attending physician considers appropriate. Educate workers about the health and safety hazards associated with coal tar creosote.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent any skin contact. With breakthrough times of >8 hr, butyl rubber, Teflon, and Viton are recommended materials. Frequent change of protective garments is an additional protective measure. Wear protective eyeglasses or chemical safety goggles and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. (The following respirator recommendations are for coal tar pitch volatiles.) For concentrations above the NIOSH REL or at any detectable concentrations, wear a SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode; or any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air- purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless (pure) or yellow to black (industrial); aromatic smoky smell.

Physical State: Oily liquid

Specific Gravity (H_2O=1, at 4 °C): 1.07 to 1.08 at 68 °F (20 °C)

Boiling Point: 381 to 752 °F (194 to 400 °C)

Water Solubility: Slightly soluble

Other Solubilities: Soluble in alcohol; ether; glycerin; dimethyl sulfate; fixed or volatile oils; in solution of fixed alkali hydroxides.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Coal tar creosote is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid excessive heat and contact with chlorosulfonic acid.

Storage Incompatibilities: Creosote oil mixed with chlorosulfonic acid in a closed container causes an increase in temperature and pressure.

Hazardous Decomposition Products: Thermal oxidative decomposition of coal tar creosote can produce carbon oxides and thick, black, acrid smoke.

Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 725 mg/kg.
Mouse, oral, LD_{50}: 433 mg/kg.

Other Effects:
Tumorgenicity, mouse, oral: 2 g/kg administered on gestational days 5-9 produced maternal effects and fetotoxicity.
Reproductive Effects - Hamster, ovary cell: 10 mg/L induced sister chromatid exchange.
Tumorigenicity: Mouse, skin, 99 g/kg/33 weeks administered intermittently produced tumors on skin and appendages (carcinogenic by RTECS criteria).
S. typhimurium: 20 µg/plate (-S9) produced mutations.

See NIOSH, *RTECS* GF8615000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: TL50, goldfish (*Carassius auratus*), 3.51 ppm/24 hr (60:40) mixture of creosote and coal tar; TL50, rainbow trout (*Salmo gairdneri*), 3.72 ppm/24 hr (60:40) mixture of creosote and coal tar; LD_{50}, bob white quail (*Colinus virginianus*), 1,260 ppm/8 days (60:40) mixture of creosote and coal tar.
Octanol/Water Partition Coefficient: log K_{ow} = 1.0

Section 13 - Disposal Considerations

Disposal: Coal tar creosote is a good candidate for rotary kiln and fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Corrosive liquids, n.o.s.
Hazard Class: 8
ID No.: UN1760
Packing Group: I, II, or III*
Label: CORROSIVE

Additional Shipping Information: * See 49 CFR 173.137 to assign Packing Group.

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Cyanide Ion **CAS Number:** 57-12-5
Chemical Formula: CN
Structural Chemical Formula: CN
Synonyms: CARBON NITRIDE ION; CYANIDE; CYANIDE(1-); CYANIDE ANION; CYANIDE ION; CYANIDE(1-) ION; CYANIDE SOLUTIONS; CYANIDE,DRY; CYANURE; HYDROCYANIC ACID,ION(1-); ISOCYANIDE
General Use: Available ONLY for industrial and manufacturing purposes.

Section 2 - Composition / Information on Ingredients

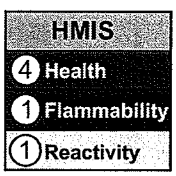
Name	CAS	%
cyanide ion	57-12-5	100

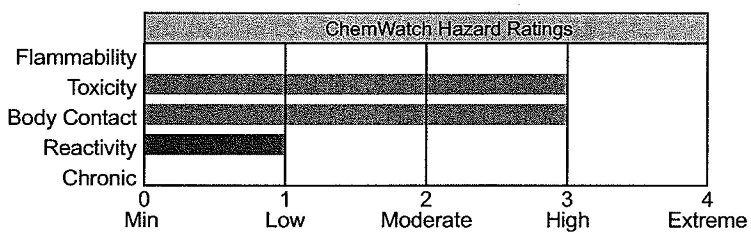
OSHA PEL
TWA: 5 mg/m^3; as CN.

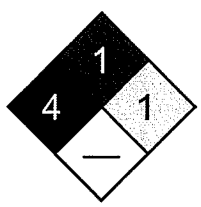
NIOSH REL
No data found.

ACGIH TLV
No data found.

Section 3 - Hazards Identification







Fire Diamond

ANSI Signal Word
Danger!


Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Almond odor. Poison. Irritating to the eyes/respiratory tract. Fast acting chemical asphyxiant that prevents tissue utilization of oxygen. Chronic: skin rash, appetite loss, weakness, dizziness, chest discomfort, nose bleed, hearing changes.

Potential Health Effects

Primary Entry Routes: inhalation, ingestion, skin absorption
Target Organs: brain, heart, lungs, skin, blood
Acute Effects
Inhalation: The dust is highly discomforting to the upper respiratory tract and extremely toxic and may be fatal. As little as a few breaths of higher concentrations of hydrogen cyanide vapor, given off from moist material, may cause instant collapse and stop breathing.
Eye: The solid/dust is corrosive to the eyes and is capable of causing severe damage with loss of sight. The material may be absorbed in toxic amounts through the eyes.
Skin: The solid/dust is highly discomforting to the skin and it is absorbed by the skin and may be fatal. The material is capable of causing chemical burns, ulceration and skin reactions which may lead to dermatitis. Exposure limits with "skin" notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard.

The material may cause second degree burns and deep ulcers. Prolonged or repeated skin contact with low concentrations of the dust may result in `cyanide rash' characterized by itching and skin eruptions.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The solid/dust is extremely toxic and may be fatal if swallowed unless immediate treatment is applied.
The adult lethal dose is less than 250 mg.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Cyanide prevents body cells from using oxygen.
Overexposure causes headache, dizziness, sweating, ineffective breathing and nausea which can be followed by a weak and irregular heartbeat, unconsciousness, convulsions, coma and death. Chronic exposure may interfere with iodine uptake by the thyroid and lead to its enlargement and related thyroid disorders. Loss of weight and appetite, mental deterioration, weakness and nervous system abnormalities may result.
Sodium cyanide is alkaline and is irritating and corrosive to body tissue.
Repeated minor contact causes cyanide rash, also itching, papules (small, superficial raised spots on the skin).
Inhalation may result in obstruction, bleeding, sloughs and in some cases perforations of the septum.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air, lay down and rest.
If not breathing, ensure clear airway, apply resuscitation.
Keep patient warm.
Use approved cyanide antidote kit.
Transport to hospital.

Eye Contact: Immediately hold eyes open and flush continuously with running water for at least 15 minutes. Ensure irrigation under eyelids.
Seek medical attention without delay.

Skin Contact: Quickly but gently, wipe material off skin with a dry, clean cloth.
Immediately remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

Ingestion: IMPORTANT: ESTABLISH A FIRST AID PLAN BEFORE WORKING WITH CYANIDES. ANTIDOTES SHOULD BE AVAILABLE ON SITE.
In all cases of cyanide exposure get medical help urgently after administering first aid.
NOTE: Amyl nitrite is no longer considered to have an antidotal role in the treatment of real or suspected cyanide poisoning. As a first aid measure its disadvantages include: (i) Vasodilatory effects may promote fatal cardiac arrhythmias (particularly if the patient is not really poisoned by cyanide), (ii) Disguise of any arrhythmias or respiratory stimuli used as an indication of true cyanide poisoning, (iii) Its role as a competitive inducer of methemoglobin in the blood-stream is highly variable and, alone, may produce levels of methemoglobin as low as 5% only.(iv) An increase in use of nitrite "poppers" as aphrodisiacs introduces substance-abuse problems.
For cyanide poisonings by any route:

1. Contact Poison Control Center.
2. Seek immediate medical attention.
3. Place casualty in coma position.
4. Give oxygen when available.
5. Consider external cardiac compression, mechanical resuscitation and use of antidote kit.
6. If breathing stops mouth-to-mouth resuscitation may be given only as a last resort. Should such resort prove necessary, first wash the casualty's mouth and lips. A first aid attendant must not inhale the expired air of the casualty.

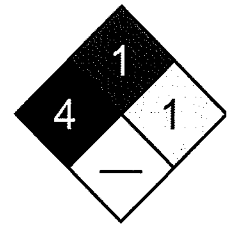
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians:
1.Signs & symptoms of acute & cyanide poisoning reflect cellular hypoxia and are often non-specific.
2.Cyanosis may be a late finding.
3.A bradycardia, hypertensive and tachypneic patient suggests poisoning especially if CNS and cardiovascular depression subsequently occurs.
4.Immediate attention should be directed towards assisted ventilation, administration of 100% oxygen, insertion of intravenous lines and institution of cardiac monitoring.
5.Obtain an arterial blood gas immediately and correct any severe metabolic acidosis (pH below 7.15).
6.Mildly symptomatic patients generally require supportive care alone.
Nitrites should not be given indiscriminately - in all cases of moderate to severe poisoning, they should be given in conjunction with thiosulfate.
As a temporizing measure supply amyl nitrite perles (0.2 mL inhaled 30 seconds every minute) until intravenous lines for sodium nitrite are established. 10 mL of a 3% solution is administered over 4 minutes to produce 20% methemoglobin in adults. Follow directly with 50 mL of 25% sodium thiosulfate, at the same rate, IV. If symptoms reappear or persist within 1/2-1 hour, repeat nitrite and thiosulfate at 50% of initial dose.
As the mode of action involves the metabolic conversion of the thiosulfate to thiocyanate, renal failure may enhance thiocyanate toxicity.

7.Methylene blue is not an antidote.

Section 5 - Fire-Fighting Measures

Flash Point: -17.8 °C Closed Cup
Extinguishing Media: Dry chemical powder.
Vaporizing liquid.
Do NOT use carbon dioxide (CO_2) or acidic chemical extinguishers.
General Fire Hazards/Hazardous Combustion Products: Pollutant. Noncombustible.
Dangerous hazard when exposed to heat or flame.
Contact with acids produces toxic fumes.
Decomposes on heating and produces toxic fumes of hydrogen cyanide, nitrogen oxides (NO_x).



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
Cool fire-exposed containers with water spray from a protected location.
Fight fire from a safe distance, with adequate cover.

Section 6 - Accidental Release Measures

Small Spills: Environmental hazard - contain spillage. Clean up all spills immediately.
Wear protective clothing, gloves, safety glasses and dust respirator.
Use dry clean-up procedures and avoid generating dust.
Sweep up.
Vacuum up or sweep up.
Place in suitable containers for disposal.
Large Spills: Pollutant - contain spillage. Clear area of personnel and move upwind.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
If contamination of drains or waterways occurs, advise emergency services.
Stop leak if safe to do so.
Increase ventilation.
Avoid generating dust.
Recover uncontaminated product in clean, dry, labeled containers.
Collect residues and seal in labeled drums for disposal.
Wash spill area with large quantities of water.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Use good occupational work practices.
Avoid generating and breathing dust.
Avoid contact with skin and eyes.
Wear personal protective equipment when handling.
When handling, DO NOT eat, drink or smoke.
Avoid contact with incompatible materials.
Avoid sources of heat.
Avoid physical damage to containers.
Use in a well-ventilated area.
Keep containers securely sealed when not in use.
Wash hands with soap and water after handling.
Launder contaminated clothing before reuse.
Recommended Storage Methods: Glass container; plastic container.
Plastic drum.
Polylined drum.
Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: If inhalation risk exists, wear NIOSH-approved respirator.
Local exhaust ventilation usually required.

Personal Protective Clothing/Equipment

Eyes: Chemical goggles. Full face shield.
Safety glasses with side shields.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves; rubber gloves.
Rubber boots.

Respiratory Protection:
Exposure Range >5 to <25 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 25 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: poor warning properties

Other: Eyewash unit. Overalls. Laboratory coat. Rubber apron.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Information applies to the cynaide ion which is a constituent of a number of cyanide compounds.

Physical State: Divided solid
Vapor Pressure (kPa): Negligible
Formula Weight: 26.02
Water Solubility: Soluble in water
pH: Not applicable
Boiling Point Range: Varies
Freezing/Melting Point Range: Varies
Volatile Component (% Vol): Negligible

Section 10 - Stability and Reactivity

Stability/Polymerization: Contact with acids produces toxic fumes.
Sodium cyanide is deliquescent and is gradually decomposed on exposure to air by reaction with carbon dioxide and moisture forming hydrogen cyanide gas.

Storage Incompatibilities: Avoid reaction with oxidizing agents. Avoid strong acids, bases.
Avoid contamination of water, foodstuffs, feed or seed.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY	IRRITATION
Intraperitoneal (mouse) LD_{50}: 3 mg/kg	Nil reported

See NIOSH, *RTECS* GS 7175000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Waste solutions can be reacted with ferrous sulfate to form relatively non-toxic ferrocyanide, or reacted with sodium hypochlorite or calcium hypochlorite to form less toxic cyanate.
Caution: Concentrated hypochlorite should not be mixed with concentrated cyanide solutions or solid cyanide because highly toxic cyanogen chloride gas will be released.
Decontaminate empty containers. Puncture containers to prevent reuse.
Bury empty containers at an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: CYANIDES, INORGANIC, SOLID, N.O.S.
Hazard Class: 6.1(a)
ID No.: 1588
Packing Group: II
Label: Poison[6]

Additional Shipping Information:

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed P030 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 10 lb (4.535 kg)
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date:.............................1999-11 **Review Date:** 2000-07

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Issue Date: 2000-07

Ethylbenzene
MSDS 385
ETH3050

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Ethylbenzene **CAS Number:** 100-41-4
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_5 \cdot C_2H_5$
Synonyms: AETHYLBENZOL; BENZENE,ETHYL-; EB; ETHYL BENZENE; ETHYLBENZEEN; ETHYLBENZENE; ETHYLBENZOL; ETILBENZENE; ETYLOBENZEN; PHENYLETHANE
General Use: Used in the manufacture of cellulose acetate, styrene and synthetic rubber; solvent or diluent; component of automotive and aviation gasoline.
Component of many petroleum hydrocarbon solvents, thinners.
The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
ethylbenzene	100-41-4	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 435 mg/m^3;
STEL: 125 ppm; 545 mg/m^3.

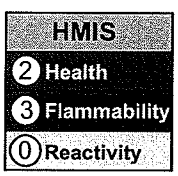
ACGIH TLV
TWA: 100 ppm; 434 mg/m^3;
STEL: 125 ppm; 543 mg/m^3.

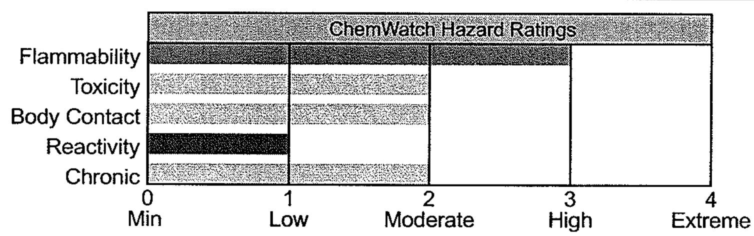
NIOSH REL
TWA: 100 ppm; 435 mg/m^3.
STEL: 125 ppm; 545 mg/m^3.

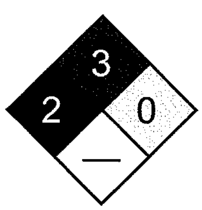
IDLH Level
800 ppm; LEL.

DFG (Germany) MAK
TWA: 100 ppm; 440 mg/m^3.

Section 3 - Hazards Identification







Fire Diamond

ANSI Signal Word

Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pungent odor. Irritating to eyes/skin/respiratory tract. Also causes: chest constriction, vertigo, narcosis, cramps, respiratory paralysis. Chronic: fatigue, sleepiness, headache, blood disorders, lymphocytosis. Flammable.

Potential Health Effects

Primary Entry Routes: inhalation, skin contact, eye contact
Target Organs: eyes, respiratory system, skin, central nervous system (CNS), blood
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.

When humans were exposed to the 100 and 200 ppm for 8 hours about 45-65% is retained in the body. Only traces of unchanged ethyl benzene are excreted in expired air following termination of inhalation exposure.

Humans exposed to concentrations of 23-85 ppm excreted most of the retained dose in the urine (mainly as metabolites).

Guinea pigs that died from exposure had intense congestion of the lungs and generalized visceral hyperemia. Rats exposed for three days at 8700 mg/m^3 (2000 ppm) showed changes in the levels of dopamine and noradrenaline in various parts of the brain.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Two drops of the material in to the conjunctival sac produced only slight irritation of the conjunctival membrane but no corneal injury.

Skin: The liquid is discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

The mean rate of absorption of liquid ethyl benzene applied to 17.3 cm2 area of the forearm of seven volunteers for 10-15 minutes was determined to be 38 mg/cm2/hr. Immersion of the whole hand in aqueous solutions of ethyl benzene (112-156 mg/l) for 1 hour yielded mean absorption rates of 118 and 215.7 ug/cm2/hr. The rate of absorption is thus greater than that of aniline, benzene, nitrobenzene, carbon disulfide and styrene.

Repeated application of the undiluted product to the abdominal area of rabbits (10-20 applications over 2-4 weeks) resulted in erythema, edema and superficial necrosis. The material did not appear to be absorbed through the skin in sufficient quantity to produce outward signs of toxicity.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce considerable gastrointestinal discomfort and may be harmful or toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Industrial workers exposed to a maximum level of ethyl benzene of 0.06 mg/l (14 ppm) reported headaches and irritability and tired quickly. Functional nervous system disturbances were found in some workers employed for over 7 years whilst other workers had enlarged livers.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water. DO NOT induce vomiting.

Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink.

Transport to hospital or doctor without delay.

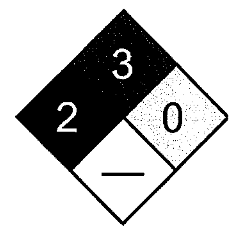
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: 12.8 °C Closed Cup
Autoignition Temperature: 432 °C
LEL: 1.6% v/v
UEL: 7% v/v



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit clouds of acrid smoke.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream with polyethylene gloves or Nitrile gloves.
Protective footwear.
Respiratory Protection:
Exposure Range >100 to <800 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 800 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Eyewash unit.
Glove Selection Index:
VITON ....A
TEFLON ....A

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid; floats on water. Aromatic solvent odor. Soluble in alcohol, benzene, carbon tetrachloride and ether.

Physical State: Liquid
Vapor Pressure (kPa): 1.333 at 25.9 °C
Vapor Density (Air=1): 3.66
Formula Weight: 106.17
Specific Gravity (H_2O=1, at 4 °C): 0.8670 at 20 °C
Water Solubility: 0.01% by weight
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 136.2 °C (277 °F) at 760 mm Hg
Freezing/Melting Point Range: -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (rat) LD_{50}: 3500 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm/8h
Inhalation (rat) LC_{Lo}: 4000 ppm/4h
Intraperitoneal (mouse) LD_{50}: 2642 mg/kg~
Dermal (rabbit) LD_{50}: 17800 mg/kg~
Liver changes, utheral tract, effects on fertility, specific developmental abnormalities (musculoskeletal system) recorded.
NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

IRRITATION
Skin (rabbit): 15 mg/24h mild
Eye (rabbit): 500 mg - SEVERE

See NIOSH, *RTECS* DA 0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it exist predominantly in the vapor phase based on its vapor pressure where it will photochemically degrade by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially return to earth in rain. It will not be subject to direct photolysis. Releases into water will decrease in concentration by evaporation and biodegradation. The time for this decrease and the primary loss processes will depend on the season, and the turbulence and microbial populations in the particular body of water. Representative half-lives are several days to 2 weeks. Some may be adsorbed by sediment but significant bioconcentration in fish is not expected to occur based upon its octanol/water partition coefficient. It is only adsorbed moderately by soil. It will not significantly hydrolyze in water or soil.
Ecotoxicity: LC_{50} Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC_{50} Pimephales promelas (fathead minnow) 12.1 mg/l/96 hr (confidence limit 11.5 - 12.7 mg/l), flow-through bioassay with measured concentrations, 26.1 °C, dissolved oxygen 7.0 mg/l, hardness 45.6 mg/l calcium carbonate, alkalinity 43.0 mg/l; Toxicity threshold (cell multiplication inhibition test): Pseudomonas putida (bacteria) 12 mg/l ; LC_{50} Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC_{50} Palaemonetes pugio (grass shrimp, larva) 10,200 ug/l/24 hr in a static unmeasured bioassay; Toxicity threshold (cell multiplication inhibition test): Microcystis aeruginosa (algae) 33 mg/l; Scenedesmus quadricauda (green algae) > 160 mg/l
Henry's Law Constant: 8.44×10^{-3}
BCF: goldfish 1.9
Biochemical Oxygen Demand (BOD): theoretical 2.8%, 5 days
Octanol/Water Partition Coefficient: $\log K_{OW} = 3.15$
Soil Sorption Partition Coefficient: $K_{OC} = 164$

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: ETHYLBENZENE
Hazard Class: 3.1
ID No.: 1175
Packing Group: II
Label: Flammable Liquid [3]

Additional Shipping Information: PHENYL ETHANE

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4); per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date:............................1999-11 **Review Date:** 2000-07

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Issue Date: 2002-02

Toluene
TOL2320

Section 1 - Chemical Product and Company Identification 54

Material Name: Toluene **CAS Number:** 108-88-3
Chemical Formula: C_7H_8
Structural Chemical Formula: $C_6H_5CH_3$
Synonyms: ANTISAL 1A; BENZENE,METHYL-; CP 25; METHACIDE; METHANE,PHENYL-; METHYL BENZENE; METHYL BENZOL; METHYLBENZENE; METHYLBENZOL; PHENYL METHANE; PHENYLMETHANE; TOLUEEN; TOLUEN; TOLUENE; TOLUENO; TOLUOL; TOLUOLO; TOLU-SOL
General Use: Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners; in gasoline and aviation fuel. Used in the manufacture of chemicals, dyes, explosives, benzoic acid.
Some grades of toluene may contain traces of xylene and benzene.
Odor threshold: 2 ppm approx. Odor is not a reliable warning property due to olfactory fatigue.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
toluene	108-88-3	> 99.5

OSHA PEL
TWA: 200 ppm; Ceiling: 300 ppm, 500 ppm, 10-minute maximum peak.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 375 mg/m^3; STEL: 150 ppm; 560 mg/m^3.

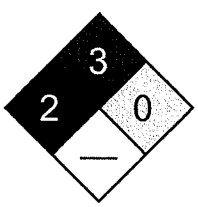
ACGIH TLV
TWA: 50 ppm, 188 mg/m^3; skin.

NIOSH REL
TWA: 100 ppm, 375 mg/m^3; STEL: 150 ppm, 560 mg/m^3.

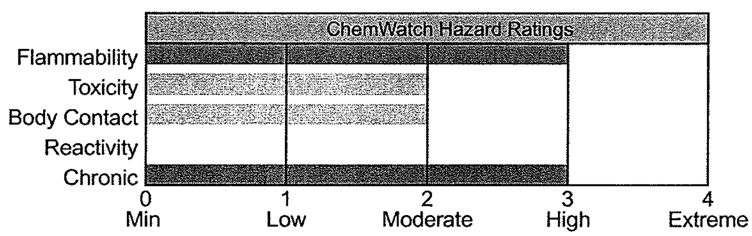
IDLH Level
500 ppm.

DFG (Germany) MAK
TWA: 50 ppm, 190 mg/m^3; skin, ceiling, substances with systemic effects, onset of effects within 2 hours, half-life two hours to shift length.

Section 3 - Hazards Identification



Fire Diamond



HMIS
2 Health
3 Flammability
0 Reactivity

ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sickly, sweet odor. Irritating to the eyes/skin/respiratory tract. Also causes: weakness, headache, dizziness, confusion, and insomnia. Chronic: liver and kidney damage. May cause birth defects. Flammable.

Potential Health Effects

Target Organs: Skin, liver, kidneys, central nervous system.
Primary Entry Routes: Inhalation, skin contact/absorbtion.
Acute Effects
Inhalation: The vapor is highly discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.
Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

Eye: The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated. The vapor is discomforting to the eyes if exposure is prolonged.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.
Defatting and/or drying of the skin may lead to dermatitis and it is absorbed by skin.
Toxic effects may result from skin absorption.
Open cuts, abraded or irritated skin should not be exposed to this material.
The material may accentuate any pre-existing skin condition.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.
Chronic toluene habituation occurs following intentional abuse (glue-sniffing) or from occupational exposure. Ataxia, incoordination and tremors of the hands and feet (as a consequence of diffuse cerebral atrophy), headache, abnormal speech, transient memory loss, convulsions, coma, drowsiness, reduced color perception, frank blindness, nystagmus (rapid, involuntary eye-movements), decreased hearing leading to deafness and mild dementia have all been associated with chronic abuse.
Peripheral nerve damage, encephalopathy, giant axonopathy, electrolyte disturbances in the cerebrospinal fluid and abnormal computer tomographic (CT) scans are common amongst toluene addicts. Although toluene abuse has been linked with kidney disease, this does not commonly appear in cases of occupational toluene exposures. Cardiac and hematological toxicity are however associated with chronic toluene exposure. Cardiac arrhythmia, multifocal and premature ventricular contractions and supraventricular tachycardia are present in 20% of patients who abused toluene-containing paints.
Previous suggestions that chronic toluene inhalation produced human peripheral neuropathy have largely been discounted. However central nervous system (CNS) depression is well documented where blood toluene levels exceed 2.2 mg%. Toluene abusers can achieve transient circulating concentrations of 6.5 mg%. Amongst workers exposed for a median time of 29 years to toluene no subacute effects on neurasthenic complaints and pyschometric test results could be established.
The prenatal toxicity of very high toluene concentrations has been documented for several animal species and man. Malformations indicative of specific teratogenicity have not generally been found. The toxicity described in the literature takes the form of embryo death or delayed fetal growth and delayed skeletal system development. Permanent damage of children has been seen only when mothers had suffered from chronic intoxication as a result of "sniffing".

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

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

Note to Physicians: Following acute or short-term repeated exposures to toluene:

1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.
The tissue/blood proportion is 1/3 except in adipose where the proportion is 8/10.
2. Metabolism by microsomal mono-oxygenation, results in the production of hippuric acid. This may be detected in the urine in amounts between 0.5 and 2.5 g/24hr which represents, on average 0.8 gm/gm of creatinine.
The biological half life of hippuric acid is in the order of 1-2 hours.
3. Primary threat to life from ingestion and/or inhalation is respiratory failure.
4. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
8. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

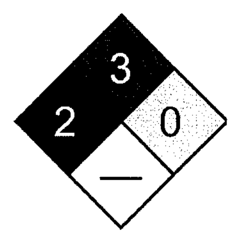
BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Hippuric acid in urine	2.5 gm/gm creatinine	End of shift Last 4 hrs of shift	B,NS
Toluene in venous blood	1 mg/L	End of shift	SQ
Toluene in end-exhaled air		End of shift	SQ

NS: Non-specific determinant; also observed after exposure to other material
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.
B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: 4 °C Closed Cup
Autoignition Temperature: 480 °C
LEL: 1.2% v/v
UEL: 7.1% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Nitric acid with toluene, produces nitrated compounds which are explosive.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.

If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; Metal drum; Metal safety cans. Packing as supplied by manufacturer.
Plastic containers may only be used if approved for flammable liquid.
Check that containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area; local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in special circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.
Provide adequate ventilation in warehouses and enclosed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:
Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Barrier cream. Eyewash unit.
Glove Selection Index:

PE/EVAL/PE	Best selection
VITON/CHLOROBUTYL	Best selection
VITON	Best selection
PVA	Best selection
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
SARANEX-23 2-PLY	Poor to dangerous choice for other than short-term immersion
CPE	Poor to dangerous choice for other than short-term immersion
VITON/NEOPRENE	Poor to dangerous choice for other than short-term immersion
SARANEX-23	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 2.93 at 20 °C
Vapor Density (Air=1): 3.2
Formula Weight: 92.14
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 20 °C
Water Solubility: < 1 mg/mL at 18 °C
Evaporation Rate: 2.4 (BuAc=1)

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 111 °C (232 °F) at 760 mm Hg
Freezing/Melting Point Range: -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from strong oxidizers.

Section 11 - Toxicological Information

TOXICITY
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 636 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm
Inhalation (man) TC_{Lo}: 200 ppm
Inhalation (rat) LC_{50}: > 26700 ppm/1h
Dermal (rabbit) LD_{50}: 12124 mg/kg
Reproductive effector in rats

IRRITATION
Skin (rabbit): 20 mg/24h-moderate
Skin (rabbit): 500 mg - moderate
Eye (rabbit): 0.87 mg - mild
Eye (rabbit): 2 mg/24h - SEVERE
Eye (rabbit): 100 mg/30sec - mild

See NIOSH, *RTECS* XS 5250000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be lost by evaporation from near-surface soil and by leaching to the groundwater. Biodegradation occurs both in soil and groundwater, but it is apt to be slow especially at high concentrations, which may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation. It will not significantly hydrolyze in soil or water under normal environmental conditions. If released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It will not significantly adsorb to sediment or bioconcentrate in aquatic organisms. If released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis.

Ecotoxicity: LC_{50} Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC_{50} Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Calandra granaria (grain weevil) 210 mg/l /in air; LC_{50} Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC_{50} Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolarvae), and 26-31 mg/l (30-day-old minnows)/ 96 hour /Conditions of bioassay not specified

Henry's Law Constant: 0.0067

BCF: eels 13.2

Biochemical Oxygen Demand (BOD): 0%, 5 days

Octanol/Water Partition Coefficient: log K_{OW} = 2.69

Soil Sorption Partition Coefficient: K_{OC} = silty loam 37

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: TOLUENE
Hazard Class: 3.1
ID No.: 1294
Packing Group: II
Label: Flammable Liquid[3]

Additional Shipping Information: TOLUOL

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U220 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Issue Date: 2000-07

Xylene
MSDS 318
XYL2260

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Xylene **CAS Number:** 1330-20-7
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
Synonyms: BENZENE,DIMETHYL-; COMPONENT 1 (83%): XYLENES; COMPONENT 2 (17%): ETHYL BENZENE; DIMETHYLBENZENE; DIMETHYLBENZENES; EPA PESTICIDE CHEMICAL CODE 086802; KSYLEN; METHYL TOLUENE; METHYLTOLUENE; VIOLET 3; XILOLI; XYLENE; XYLENEN; XYLOL; XYLOLE
General Use: A strong solvent for general use in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
xylene	1330-20-7	> 95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

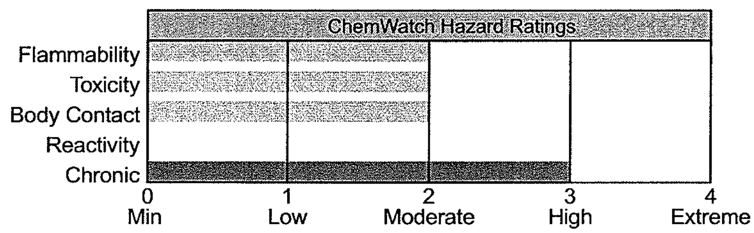
ACGIH TLV
TWA: 100 ppm; 434 mg/m^3;
STEL: 150 ppm; 651 mg/m^3.

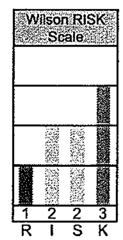
NIOSH REL
TWA: 100 ppm; 435 mg/m^3.
STEL: 150 ppm; 655 mg/m^3.

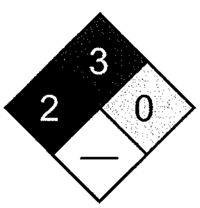
DFG (Germany) MAK
TWA: 100 ppm; 440 mg/m^3.

Section 3 - Hazards Identification

HMIS
2 Health
3 Flammability
0 Reactivity







Fire Diamond

ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to the eyes/skin/respiratory tract. Also causes: dizziness, nausea, and drowsiness. Chronic: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects based on animal data. Flammable.

Potential Health Effects

Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Acute Effects
Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration. The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Small excess risks of spontaneous abortion and congenital malformation was reported amongst women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances.

Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

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

Note to Physicians: For acute or short-term repeated exposures to xylene:

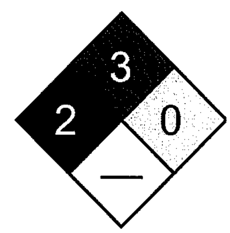
1.Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended. The use of charcoal and cathartics is equivocal.
2.Pulmonary absorption is rapid with about 60-65% retained at rest.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures

Flash Point: 25.6 °C
Autoignition Temperature: 241 °C
LEL: 1.0% v/v
UEL: 7.0% v/v



Fire Diamond

Extinguishing Media: Alcohol stable foam; dry chemical powder; carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of overexposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Plastic containers may only be used if approved for flammable liquids.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream with polyethylene gloves; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.

Glove Selection Index:

PE/EVAL/PE	A
PVA	A
VITON	A
TEFLON	A
PVDC/PE/PVDC	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE+PVC	C
HYPALON	C
NAT+NEOPR+NITRILE	C
BUTYL	C
BUTYL/NEOPRENE	C
NITRILE	C
NEOPRENE	C

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

PVC..C

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear colorless flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Water Solubility: Practically insoluble in water
Evaporation Rate: 0.7 Bu Ac=1
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 137 °C (279 °F) to 140 °C (284 °F)
Freezing/Melting Point Range: -47 °C (-53 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 4300 mg/kg
Inhalation (human) TC_{Lo}: 200 ppm
Inhalation (man) LC_{Lo}: 10000 ppm/6h
Inhalation (rat) LC_{50}: 5000 ppm/4h
Reproductive effector in rats

IRRITATION
Skin (rabbit):500 mg/24h moderate
Eye (human): 200 ppm irritant
Eye (rabbit): 87 mg mild
Eye (rabbit): 5 mg/24h SEVERE

See NIOSH, *RTECS* ZE 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most of the xylenes are released into the atmosphere where they may photochemically degrade by reaction with hydroxyl radicals (half-life 1-18 hr). The dominant removal process in water is volatilization. Xylenes are moderately mobile in soil and may leach into groundwater where they are known to persist for several years, despite some evidence that they biodegrade in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD_{50} Goldfish 13 mg/l/24 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.22
BCF: estimated at 2.14 to 2.20
Octanol/Water Partition Coefficient: log K_{ow} = 3.12 to 3.20
Soil Sorption Partition Coefficient: K_{oc} = 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: XYLENES
Hazard Class: 3.2
ID No.: 1307
Packing Group: III
Label: Flammable Liquid[3]

Additional Shipping Information: XYLOLS

Section 15 - Regulatory Information

EPA Regulations:
- **RCRA 40 CFR:** Listed U239 Toxic Waste; Ignitable Waste
- **CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4); per RCRA Section 3001 100 lb (45.35 kg)
- **SARA 40 CFR 372.65:** Listed
- **SARA EHS 40 CFR 355:** Not listed
- **TSCA:** Listed

Section 16 - Other Information

Research Date:............................1999-11 **Review Date:** 2000-07

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Appendix G

Forms & Logs

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Infrastructure, environment, facilities

VEHICLE PRE-TRIP CHECK

Date: ______________________________

Unit: ______________________________

Operator: ______________________________

CHECK BEFORE OPERATING	OK	NR	COMMENTS
Driver's License on hand?			
Insurance card in car?			
Back-up Alarm Operational?			
Tires (tread greater than top of Lincolns head on a penny)			
Taillights Operational			
Turn Signals Operational			
Brake Lights Operational			
Back-up Lights Operational			
Headlights Operational			
Parking Lights Operational			
Mirrors Adjusted to Minimize Blind Spots			
Under the Vehicle - nothing hanging, no leaks			
Windshield Wipers and Fluid all Functional			
Heavy items secured down low or in trunk			
Make Sure All Doors are Fully Closed and Locked			
Adjust Your Seat if Needed			
Adjust Your Head Restraint to Match Height of Head			
Fasten Your Safety Belt and Make Sure Passengers do too			
Start the Engine			
Scan the Gauges to Make Sure Everything is Normal			
Adjust the Vents, Windows, and Heater or Air Conditioner for Comfort			
Make Sure You are Mentally and Physically Ready to Drive			

NR = Needs Repair

This checklist should be completed before operating a vehicle on ARCADIS BBL/BBLES business. When multiple stops are planned, the driver should walk around the vehicle after each stop to validate tire inflation and vehicle integrity.

Imagine the result

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SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

This briefing form documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing, at least daily.

Project Number:		**Project Name:**
Date:	**Time:**	**Briefing Conducted by:**
Company:		**Signature/Title:**

TRACKing the Tailgate Briefing

Think through the Tasks (list the tasks for the day):

1 ______ 3 ______ 5 ______

2 ______ 4 ______ 6 ______

Recognize the hazards (check all those that are discussed) and **Assess** the Risks (Low, Medium, High-circle risk level)

☐ Confined Space	(L M H)	☐ Buried/Overhead Utilities	(L M H)	☐ Excavation	(L M H)
☐ Walking/Working surfaces	(L M H)	☐ Chemical Exposure	(L M H)	☐ Noise	(L M H)
☐ Thermal Stress (Hot/Cold)	(L M H)	☐ Overhead Hazards	(L M H)	☐ Traffic/Roadway/Railway	(L M H)
☐ Severe Weather	(L M H)	☐ Chemical Usage	(L M H)	☐ Elevated work	(L M H)
☐ Hazardous Energy	(L M H)	☐ Heavy Machinery	(L M H)	☐ Biological/Animals	(L M H)
☐ Ergonomic	(L M H)	☐ Personal Safety/Security	(L M H)	☐ Mining	(L M H)
☐ Client/Other Site Activities	***List***	☐ Chemical Exposure	***List***	☐ Other	***Specify***
______	(L M H)	______	(L M H)	______	(L M H)
______	(L M H)	______	(L M H)	______	(L M H)
______	(L M H)	______	(L M H)	______	(L M H)

Control the hazards (Check all those methods to control the hazards that apply):

☒ **STOP WORK AUTHORITY** (Must be addressed in every Tailgate meeting-*See H&S Handbook for definition*)

☐ General PPE Usage	☐ Hearing Conservation	☐ Respiratory Protection
☐ Personal Hygiene	☐ Exposure Guidelines	☐ Decon Procedures
☐ Emergency Action Plan	☐ Fall Protection	☐ Work Zones/Site Control
☐ JSA to be developed/used ***(specify)***	☐ LPO conducted ***(specify job/JSA)***	☐ Other ***(specify)***
______	______	______
______	______	______
______	______	______

Personnel Sign-in List

Printed Name	Signature

Keep H&S 1st in all things

Use the back to add comments such as recent near misses, injuries or property damage, visitors to the site, etc

SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

Additional Comments:

Discussion of recent results of LPOs conducted on the project:

Discussion of recent Near-miss, injuries, and/or property damage on the project:

List Visitors to Site Today:

Visitor Acknowledgement and Acceptance of HASP Signature Form

By signing below, I waive, release and discharge the owner of the site and ARCADIS and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the site and in any way arising from or related to any and all known and unknown conditions on the site.

Name	Company	Reason for Visit	Date/Time On Site	Date/Time Off Site

ARCADIS
infrastructure, environment, buildings

Air Monitoring Log

Project: **Date:**

Monitoring Instruments:

Air Monitor: **Activity:**

Level of Protection:

Time	Location	Instrument Reading	Comments

Real Time Exposure Monitoring Data Collection Form

Document all air monitoring conducted on the Site below. Keep this form with the project file.

Site Name: ______________________________ Date: ______________

Instrument: ______________ Model: ______________ Serial #: ______________

Calibration Method: (Material used settings, etc.)	
Calibration Results:	
Calibrated By:	

Activity Being Monitored	Compounds/Hazards Monitored	Time	Reading	Action Required? Y/N

Describe Any Actions Taken as a Result of this Air Monitoring and Why (does it match Table 5-1):

____

____

Hazardous Materials Shipment Form

Material Description and Proper Shipping Name (per DOT or IATA)	Shipment Quantity	DOT Hazard Classification	Shipment Method (air/ground)

List Shipper (i.e., who we are offering the shipment to):

____

____

List Trained Employee(s):

____

____

Hazardous Materials Transportation Form

	Vehicle (place X in box)	Type (pick-up, car, box truck, etc.)
Personal		
Rental		
ARCADIS owned/leased		
Government owned		
Trailer		

Materials Transported	Quantity	Storage/Transport Container

List Trained Drivers:

____

____

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Appendix H

Emergency Action Plan and
Route to Hospital

EMERGENCY ACTION PLAN

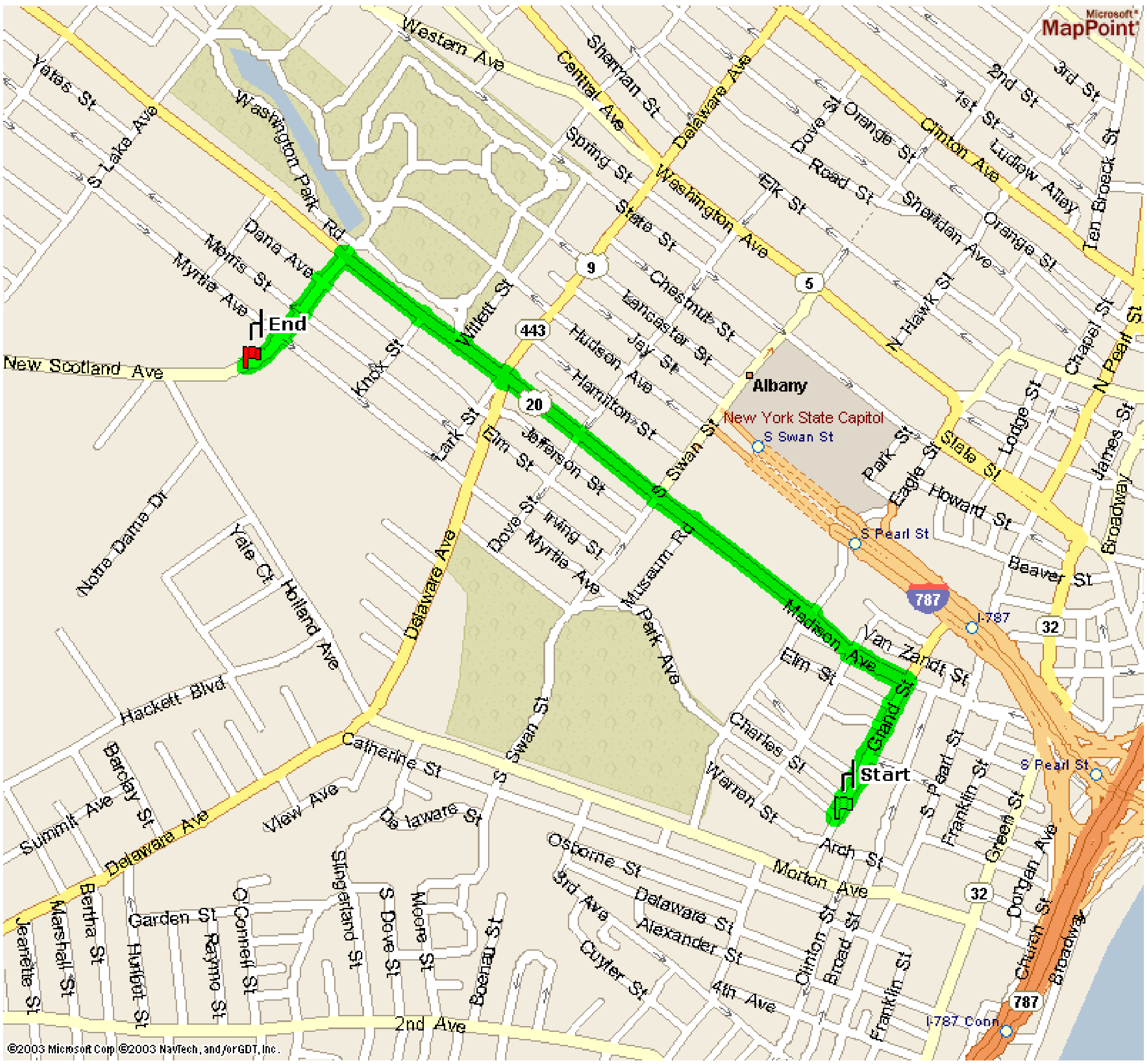
Emergency Contact List

Emergency Contact	Phone
Local Police –Albany Police Department	911 and 518.462.8050
Local Ambulance –	911
Local Fire Department – Albany Fire Department	911 and 518.447.7879
Local Hospital – Albany Medical Center 43 New Scotland Avenue, Albany, New York 12208	911 and 518.262.2131
Local Weather Data – National Weather Service	http://forecast.weather.gov mobile.weather.gov cell.weather.gov
Poison Control	800.332.3073
National Response Center (all spills in reportable quantities)	800.424.8802
U.S. Coast Guard (spills to water)	800.424.8802
Project Manager – Michael Jones	315.671.9211
Site Manager – Andrew Korik	315.671.9323
H&S Officer – Charles Webster, CSP	315.671.9297 Cell: 315.247.5971
Client Contact – James Morgan	315.428.3101

The Hospital Route Map is provided below. It is the responsibility of the HSS to verify the hospital directions prior to the start of work.

DIRECTIONS TO THE HOSPITAL

Start: Depart Grand St & Park Ave, Albany, NY 12202 on Grand St (North)	**0.2 miles**
1: Turn LEFT (West) onto US-20 [Madison Ave]	**1.0 miles**
2: Turn LEFT (South-West) onto New Scotland Ave	**0.2 miles**
End: Arrive 43 New Scotland Ave, Albany, NY 12208	



List the Emergency Notification Procedure for the project:

- Step 1: Evaluate the incident and assess the need for assistance and/or evacuation;
- Step 2: Call for outside assistance as needed;
- Step 3: Confirm that the PM is notified promptly of the incident; and
- Step 4: Take appropriate measures to stabilize the incident scene.

If emergency attention is not needed but professional medical attention is necessary, the employee will be taken to (see hospital route):

Medical Facility:	Albany Medical Center
Address:	43 New Scotland Avenue, Albany, New York 12208
Phone Number:	518.262.2131

Emergency Supplies and Equipment List

Emergency Supplies and Equipment (check all that apply)		Location on Project Site
☒ First Aid Kit (type):		Arcadis Vehicle
☒ Fire Extinguisher		Arcadis Vehicle
☒ Mobile Phone	☐ Satellite Phone	Arcadis Vehicle
☒ Traffic Cones		Arcadis Vehicle
☐ Walkie Talkies		
☒ Water or Other Fluid Replenishment		Arcadis Vehicle
☐ Eye Wash/Quick Drench Station		
☒ Eye Wash Bottle		Arcadis Vehicle
☒ Wash and Dry Towelettes		Arcadis Vehicle
☒ Sunscreen (SPF 15 or higher)		Arcadis Vehicle
☒ Insect Repellant		Arcadis Vehicle
☐ Chemical Spill Kit		
☐ *Other (specify):*		

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Appendix D

Community Air Monitoring Plan

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Infrastructure · Water · Environment · Buildings

Imagine the result

nationalgrid

Appendix D

Community Air Monitoring Plan

Albany (Grand Street) Non-Owned Former MGP Site

June 2012

Table of Contents

1. Introduction

This Community Air Monitoring Plan (CAMP) has been prepared by ARCADIS to support implementation of ongoing groundwater monitoring activities at the National Grid Albany (Grand Street) non-owned former manufactured gas plant (MGP) site located on Grand Street in Albany, New York (the Site). This CAMP fulfills the requirements set forth by the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (GCAMP), dated June 2000 (Exhibit I), and the New York State Department of Environmental Conservation's (NYSDEC's) Technical and Administrative Guidance Memorandum (TAGM) 4031, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites" (Exhibit II). This CAMP presents monitoring activities that will be conducted to detect potential airborne releases of constituents of concern during implementation of the ongoing groundwater monitoring activities. The CAMP also specifies the air emissions action levels, air monitoring procedures, monitoring schedule and data collection and reporting to be performed during implementation of the ongoing groundwater monitoring activities.

1.1 Site Description

The Site is bordered by Grand Street to the west, residential buildings and a multistory apartment building (the Schuyler Apartments, which was previously a school) to the north, Trinity Place to the east, and Arch Street to the south. The National Grid Trinity Substation occupies the northern portion of the Grand Street parcel and vacant multistory industrial buildings (the former F. Jacobson & Sons Shirt Factory) occupy the southern portion of the parcel. One of the vacant buildings along Grand Street (95 Trinity Place as shown on Figure 2 in the Site Management Plan) was recently purchased by the Capital City Rescue Mission and current plans included developing the building into 44 temporary residence/itinerant apartments. The Trinity Substation is surrounded by an approximately 10-foot-high concrete wall. Access to the substation is restricted by locked gates located in the southwest (along Grand Street) and northeast (along Trinity Place) corners of the substation. Access to the southern portion of the parcel (the industrial buildings) is limited, with the exception of one driveway located along Arch Street which services a loading dock on the north side of the building.

1.2 Ongoing Monitoring Activities

The ongoing groundwater monitoring activities primarily include: 1) monitoring groundwater quality and flow conditions; and 2) potential monitoring well repairs, replacement, and decommissioning.

1.3 Potential Air Emissions Related to Ongoing Monitoring/Recovery Activities

As defined in the NYSDOH GCAMP, intrusive ongoing monitoring activities to be performed at the Site have the potential to generate localized impacts to air quality. These ongoing monitoring activities include, but may not be limited to, the following:

- Sampling of groundwater in monitoring wells; and
- Potential monitoring well repairs, replacement, and decommissioning.

1.4 Air/Dust Emissions and Control Measures

Air emissions control and fugitive dust suppression measures will be implemented concurrently with the activities identified above (as needed) to limit the potential for organic vapor and dust emissions from the Site. Air emissions associated with groundwater monitoring, and potential monitoring well repairs, replacement, and decommissioning, and certain nonintrusive activities, such as mobilization, transportation, and restoration activities, will be controlled as necessary. The following vapor and dust control measures may be used during these activities, depending on specific circumstances, visual observations, and air monitoring results:

- Water spray.
- Polyethylene sheeting (for covering material stockpiles, etc.).
- Minimizing drilling/excavation surface area to be exposed at any given time.
- Vapor suppression foams.

Prior to implementing intrusive work activities, a supply of materials for the above-referenced control measures will be obtained, as necessary. An adequate supply of such materials will be maintained for the duration of intrusive activities.

2. Air Monitoring Procedures

Real-time air monitoring will be implemented at representative locations in the vicinity of the ongoing monitoring/recovery activities for organic vapors and particulate matter less than 10 microns in diameter (PM_{10}). Real-time air monitoring for organic vapors will be conducted during the groundwater monitoring activities. Real-time monitoring for organic vapors and PM_{10} will be conducted during all ground intrusive activities (including potential monitoring well repairs, replacement, and decommissioning). Details of the air monitoring, including information regarding the monitoring locations, are presented below.

2.1 Monitoring Station Location Selection and Deployment

Prior to the initiation of and during all intrusive activities, organic vapors and PM_{10} monitoring station locations will be determined daily based on data from an onsite meteorological monitoring station and the nature of the anticipated intrusive work activities. An upwind location for both organic vapors and PM_{10} monitoring will be selected at the start of each workday. One downwind (based on predominant wind direction) location for both volatile organic compounds (VOCs) and PM_{10} monitoring will also be selected. The organic vapor and PM_{10} monitoring stations will be deployed each day before the start of intrusive work activities. If wind direction shifts radically during the workday and for an extended period of time, such that the upwind location and the downwind location no longer fall within acceptable guidelines (+/- 60° compass change from the original wind direction), the monitoring stations will be relocated so that the upwind and downwind locations are maintained. Air monitoring location changes will be documented by the field logbook.

2.2 PAHs and VOCs Monitoring

Because real-time monitors for polycyclic aromatic hydrocarbons (PAHs) do not exist, the real-time VOC and particulate monitors will also serve as surrogate indicators of PAH emissions at the Site. The real-time particulate monitoring is described in Section 2.3. As required by the NYSDOH GCAMP, VOCs will be monitored continuously during implementation of the groundwater monitoring activities and all intrusive activities (i.e., monitoring well/recovery well repairs, replacement, and decommissioning) using instrumentation equipped with electronic data-logging capabilities. A real-time VOC monitor (MiniRAE 2000 [or equivalent]), equipped with either a photo-ionization detector (PID) calibrated to 10 parts per million (ppm) Isobutylene, or a flame-ionization detector (FID), will be used to conduct the monitoring for VOCs (and PAHs). All running average (15-minute intervals) concentrations and any instantaneous readings that support decisions regarding the remedial activities will be recorded by the Contractor using an electronic data logger and/or in the field logbook.

2.3 PM_{10} Monitoring

Fugitive dust migration will be visually assessed during work activities, and reasonable dust suppression techniques will be used during Site activities that may generate fugitive dust. These activities and their design controls are discussed in Section 1.4.

As required by the NYSDOH GCAMP, real-time airborne particulate monitoring will be conducted continuously during intrusive activities, including monitoring well/recovery well repairs, replacement, and decommissioning. Particulate monitoring will be conducted using instrumentation equipped with electronic data-logging capabilities. As previously discussed in Subsection 2.2, particulate monitoring will also serve as a surrogate indicator of PAH emissions at the Site. A MIE DataRAM (or equivalent) will be used to conduct the real-time PM_{10} monitoring. Concentration readings will be recorded as specified in Subsection 2.2 above.

2.4 Action Levels

The action levels provided below will be used to initiate response actions, if necessary, based on real-time monitoring. Each piece of monitoring equipment will have alarm capabilities to indicate exceedances of the action levels indicated below.

2.4.1 Action Levels for VOCs

As outlined in the NYSDOH GCAMP, if the ambient air concentration of total VOCs at any one (or more) of the downwind perimeter locations exceeds 5 ppm above the background (upwind location) concentrations for a 15-minute average, intrusive activities will be temporarily halted while monitoring continues. If the total VOC concentration readily decreases (through observation of instantaneous readings) below 5 ppm above background, then intrusive activities can resume with continuous monitoring.

If the ambient air concentrations of total VOCs at any one (or more) of the downwind perimeter locations persist (despite cessation of work activities) at levels in excess of 5 ppm above background but less than 25 ppm above background, intrusive activities will be halted, the potential source(s) of the elevated VOC concentrations will be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will be continued. Once these actions have been performed, intrusive activities can resume provided that the TOV level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

If the ambient air concentrations of total VOCs at one (or more) of the downwind perimeter locations are above 25 ppm above background, the intrusive activities must cease, and emissions control measures must be implemented.

2.4.2 Action Levels for PM_{10}

As required by the NYSDOH GCAMP, if the ambient 15-minute average PM_{10} air concentration at any one (or more) of the downwind perimeter locations is noted at levels in excess of 100 micrograms per cubic meter (µg/m3) above the background concentration, or if airborne dust is visually observed leaving the work area, then dust suppression activities will be implemented, and air monitoring will continue. Work may continue following the implementation of dust-suppression techniques provided the PM_{10} levels do not exceed 150 µg/m^3 above background, and no visible dust is observed migrating from the work areas.

If, after implementation of dust-suppression techniques, the downwind PM_{10} levels are greater than 150 µg/m^3 above background, work must be stopped and Site activities must be re-evaluated. Once additional actions have been implemented, work may resume only if dust-suppression measures and other controls are successful in reducing the 15-minute average PM_{10} levels to less than 150 µg/m3 above background at the downwind perimeter of the Site and if no visible dust is observed migrating from the work area.

2.5 Meteorological Monitoring

Meteorological monitoring will be conducted continuously at the Site using available local meteorological monitoring stations and a wind sock to indicate wind direction.

2.6 Instrument Calibration

Calibration of the VOC and PM_{10} monitoring instrumentation will be conducted in accordance with the equipment manufacturer's calibration and quality assurance requirements. The VOC and PM_{10} monitors will be calibrated at least daily, and calibrations will be recorded by the Contractor in the field logbook.

3. Monitoring Schedule and Data Collection/Reporting

The following identifies the monitoring schedule and data collection/reporting requirements.

3.1 Monitoring Schedule

As previously indicated, real-time air monitoring for organic vapors will be conducted during the groundwater and DNAPL monitoring/recovery activities. Real-time monitoring for organic vapors and PM_{10} will be conducted during all ground intrusive activities and/or potential dust-generating activities (including potential monitoring well/recovery well repairs, replacement, and decommissioning). Air monitoring will be conducted prior to initiating intrusive work activities to establish adequate baseline data and until such time that significant soil handling activities are complete (i.e., removal of impacted soils staged onsite). With respect to soils that are to be staged onsite, air monitoring will be performed during periods when the staging area is "active" (i.e., when soils are being added or removed from the stockpile). When the staging areas are "inactive," the affected soils will be covered with suitable tarpaulins or plastic sheeting, which will be anchored to resist potential wind- and rainfall-related upsets. The frequency of air monitoring will be relative to the level of site work activities being conducted and may be adjusted as the work proceeds and in consideration of the monitoring results.

3.2 Data Collection and Reporting

Air monitoring data will be collected continuously from VOC and PM_{10} monitors during ongoing monitoring/recovery activities (as detailed above) by the electronic data-logging system. The data management software will be set up so that instantaneous observed readings will be recorded by the electronic data acquisition system and averaged over 15-minute periods. All readings will be recorded and archived to facilitate subsequent review by NYSDOH and NYSDEC personnel.

Exhibits

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Exhibit I

Generic Community Air Monitoring Plan

APPENDIX 1A

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

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

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

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Exhibit II

NYSDEC TAGM 4031-Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites

New York State Department of Environmental Conservation

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM #4031

FUGITIVE DUST SUPPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES

TO: Regional Hazardous Waste Remediation Engrs., Bur. Directors & Section Chiefs

FROM: Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation

SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM -- FUGITIVE DUST SUPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES

DATE: Oct 27, 1989

Michael J. O'Toole, Jr. (signed)

1. Introduction

Fugitive dust suppression, particulate monitoring, and subsequent action levels for such must be used and applied consistently during remedial activities at hazardous waste sites. This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

2. Background

Fugitive dust is particulate matter--a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles, liquid droplets or solids, over a wide range of sizes--which becomes airborne and contributes to air quality as a nuisance and threat to human health and the environment.

On July 1, 1987, the United States Environmental Protection Agency (USEPA) revised the ambient air quality standard for particulates so as to reflect direct impact on human health by setting the standard for particulate matter less than ten microns in diameter (PM_{10}); this involves fugitive dust whether contaminated or not. Based upon an examination of air quality composition, respiratory tract deposition, and health effects, PM_{10} is considered conservative for the primary standard--that requisite to protect public health with an adequate margin of safety. The primary standards are 150 ug/m^3 over a 24-hour averaging time and 50 ug/m^3 over an annual averaging time. Both of these standards are to be averaged arithmetically.

There exists real-time monitoring equipment available to measure PM_{10} and capable of integrating over a period of six seconds to ten hours. Combined with an adequate fugitive dust suppression program, such equipment will aid in preventing the off-site migration of contaminated soil. It will also protect both on-site personnel from exposure to high levels of dust and the public around the site from any exposure to any dust. While specifically intended for the protection of on-site personnel as well as the public, this program is not meant to replace long-term monitoring which may be required given the contaminants inherent to the site and its air quality.

3. Guidance

A program for suppressing fugitive dust and monitoring particulate matter at hazardous waste sites can be developed without placing an undue burden on remedial activities while still being protective of health and environment. Since the responsibility for implementing this program ultimately will fall on the party performing the work, these procedures must be incorporated into appropriate work plans. The following fugitive dust suppression and particulate monitoring program will be employed at hazardous waste sites during construction and other activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Such activities shall also include the excavation, grading, or placement of clean fill, and control measures therefore should be considered.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM_{10}) with the following minimum performance standards:

   Object to be measured: Dust, Mists, Aerosols
   Size range: <0.1 to 10 microns
   Sensitivity: 0.001 mg/m^3
   Range: 0.001 to 10 mg/m^3
   Overall Accuracy: ±10% as compared to gravimetric analysis of stearic acid or reference dust

   Operating Conditions:
   Temperature: 0 to 40°C
   Humidity: 10 to 99% Relative Humidity

   Power: Battery operated with a minimum capacity of eight hours continuous operation

   Automatic alarms are suggested.

   Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. Consequently, instrumentation shall require necessary averaging hardware to accomplish this task; the P-5 Digital Dust Indicator as manufactured by MDA Scientific, Inc. or similar is appropriate.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the entity operating the equipment to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m^3 over the integrated period not to exceed 15 minutes. While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m^3, the upwind background level must be measured immediately using the same portable monitor. If the working site particulate measurement is greater than 100 ug/m^3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see Paragraph 7). Should the action level of 150 ug/m^3 be exceeded, the Division of Air Resources must be notified in writing within five working days; the notification shall include a description of the control measures implemented to prevent further exceedences.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM_{10} at or above the action level. Since this situation has the potential to migrate contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

    1. Applying water on haul roads.
    2. Wetting equipment and excavation faces.
    3. Spraying water on buckets during excavation and dumping.
    4. Hauling materials in properly tarped or watertight containers.
    5. Restricting vehicle speeds to 10 mph.
    6. Covering excavated areas and material after excavation activity ceases.
    7. Reducing the excavation size and/or number of excavations.

    Experience has shown that utilizing the above-mentioned dust suppression techniques, within reason as not to create excess water which would result in unacceptable wet conditions, the chance of exceeding the 150 ug/m^3 action level at hazardous waste site remediations is remote. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. If the dust suppression techniques being utilized at the site do not lower particulates to an acceptable level (that is, below 150 ug/m^3 and no visible dust), work must be suspended until appropriate corrective measures are approved to remedy the situation. Also, the evaluation of weather conditions will be necessary for proper fugitive dust control--when extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended.

There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require appropriate toxics monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

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Appendix E

Site-Wide Inspection Form

Albany (Grand Street) Non-Owned Former MGP Site

Albany, Albany County, New York

Site Wide Inspection Form

Date: ______________________ **Weather Conditions:** ______________________

Personnel: ______________________ **Temperature:** ______________________

______________________ **Wind Speed:** ______________________

Time of Arrival: ______________________ **Wind Direction (from):** ______________________

Time of Departure: ______________________

Inspection Checklist	Yes	No	Comments
Cover System			
- Soil intrusion activities being performed?			
- Signs of soil intrusive activities?			
- Evidence of saw cutting?			
- Evidence of excavation or trenching?			
- Burrowing animals?			
Monitoring Well Condition			
- Monitoring event occurring?			
- Covers secure?			
- Casing in need of repair?			
- Concrete surface seal intact?			
- Obstructed?			
- Settling?			

General Comments/Suggested Action Items:

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Appendix F

Monitoring Well Boring and Construction Logs

Date Start/Finish: 6/8/04-6/8/04
Drilling Company: Parratt-Wolff
Driller's Name: R. Navatka and B. Palmer
Drilling Method: Hollow Stem Auger
Bit Size: 8.25" OD (Cutting Diameter)
Auger Size: 4.25" ID
Rig Type: Diedrich D-50
Sampling Method: 2" and 3" OD x 2' Split Spoon

Northing: 1388896.17
Easting: 691578.22
Casing Elevation: 55.49 ft. AMSL

Borehole Depth: 42' below grade
Surface Elevation: 55.81 ft. AMSL

Geologist: Dave Cornell

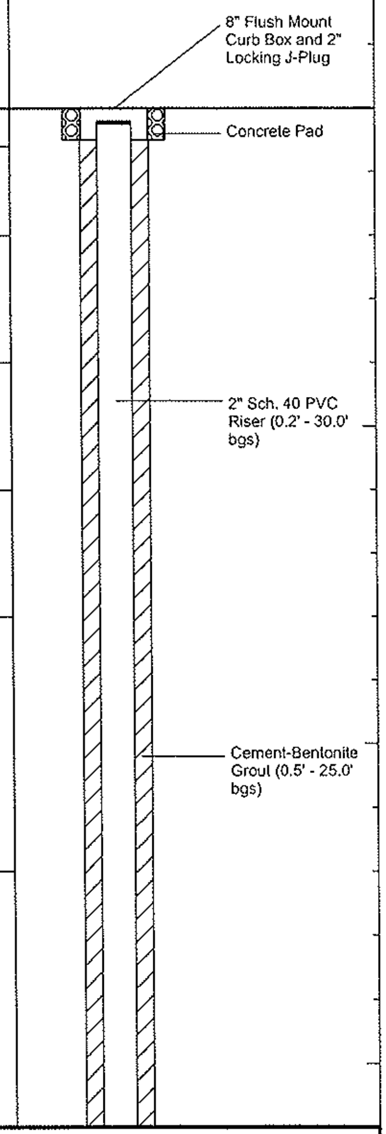
Well/Boring ID: MW-5

Client: Niagara Mohawk

Location: Grand Street
Non-Owned Former MGP Site
Albany, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	55	1	0-2	1.4	2 2 2 4	4	ND			Brown fine Sandy SILT, little Roots, non-plastic, moist. [Topsoil] Orange-brown fine SAND, little Silt, trace fine Gravel, soft, non-plastic, moist. [Fill]
		2	2-4	1.0	3 4 3 3	7	ND			Black CINDERS and SLAG, moist. [Fill]
5	50	3	4-6	0.9	1 1 2 3	3	ND			Dark brown fine SAND and SILT, little Slag and Cinders, soft, non-plastic, moist. [Fill]
		4	6-8	0.3	3 3 2 3	5	ND			Black CINDERS and SLAG, moist. [Fill]
		5	8-10	1.6	2 1 3 5	4	ND			Brown Silty CLAY, turning gray at 8.4' bgs, moderately plastic, moist.
10	45	6	10-12	0.3	1 1 2 3	3	ND			
		7	12-14	1.9	5 5 5 5	10	ND			Gray Silty CLAY, trace fine Sand, moderately plastic, moist.
15	40	8	14-16	1.9	1 1 1 1	2	ND			

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod; ft. AMSL = feet above mean sea level.
Soil samples collected from 16.0' - 17.6' bgs for PAH, and Total CN; from 20.0' - 21.0' bgs for TOC; and from 30.0' - 32.0' bgs (also Dup-2) for VOCs, PAHs and Total CN.

Client:
Niagara Mohawk

Site Location:
Grand Street
Non-Owned
Former MGP Site

Well/Boring ID: MW-5

Borehole Depth: 42' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Stratigraphic Description
		9	16-18	1.6	2 2 1 2	3	ND	X	Gray Silty CLAY, trace fine Sand, moderately plastic, moist.
		10	18-20	0.8	WOR WOR 1 1	1	ND		Gray Silty CLAY, slightly plastic, wet to saturated.
20	35	11	20-22	1.1	WOR 1 1 1	2	ND	X	
		12	22-24	2.0	1 1 1 1	2	ND		Gray-brown CLAY and SILT, slightly plastic, wet to saturated.
25	30	13	24-26	2.0	1 1 1 1	2	ND		Gray Silty CLAY, plastic, wet.
		14	26-28	1.5	WOR/2	<1	ND		
		15	28-30	1.9	WOR/2	<1	ND		Trace Silty fine SAND seams below 29.4' bgs.
30	25	16	30-32	2.0	2 4 3 3	7	20.3	X	Faint odor below 30.0' bgs. Increased fine SAND seams below 29.4' bgs.
		17	32-34	2.0	1 1 1 1	2	15.4		Gray Silty CLAY interbedded with SILT and fine SAND, moderately plastic, wet.
35	20	18	34-36	2.0	1 1 1 2	2	12.6		

Well/Boring Construction

- 2" Sch. 40 PVC Riser (0.2' - 30.0' bgs)
- Cement-Bentonite Grout (0.5' - 25.0' bgs)
- Bentonite Seal (25.0'- 28.0' bgs)
- #0 Silica Sand Pack (28.0' - 40' bgs)
- 2" 0.010 Slot Sch. 40 PVC Screen (30.0 - 40.0' bgs)

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod; ft. AMSL = feet above mean sea level.
Soil samples collected from 16.0' - 17.6' bgs for PAH, and Total CN; from 20.0' - 21.0' bgs for TOC; and from 30.0' - 32.0' bgs (also Dup-2) for VOCs, PAHs and Total CN.

Client:
Niagara Mohawk

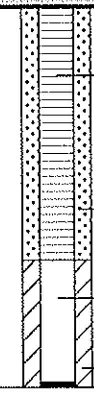
Site Location:
Grand Street
Non-Owned
Former MGP Site

Well/Boring ID: MW-5

Borehole Depth: 42' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
		19	36-38	2.0	WOR WOR 1 1	1	ND			Gray Silty CLAY interbedded with fine Sandy SILT, plastic, wet to saturated.
		20	38-40	0.0	WOR WOR 1 1	1	ND			No recovery.
40	15	21	40-42	1.8	WOR WOR 1 1	1	3.5			Gray Silty CLAY, plastic, wet, interbedded with SILT and fine SAND, non-plastic, saturated.
45	10									
50	5									
55	0									

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod; ft. AMSL = feet above mean sea level.
Soil samples collected from 16.0' - 17.6' bgs for PAH, and Total CN; from 20.0' - 21.0' bgs for TOC; and from 30.0' - 32.0' bgs (also Dup-2) for VOCs, PAHs and Total CN.

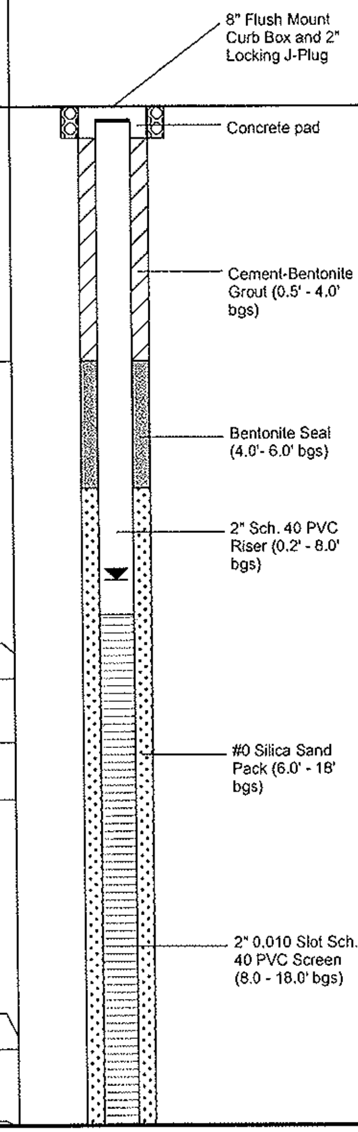
Project: 36639.008
Data File:MW-5.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36639\Grandstreet.ldf
Date: 6/22/04

Date Start/Finish: 6/23/04-6/23/04 **Drilling Company:** Parratt-Wolff **Driller's Name:** R. Navatka and B. Palmer **Drilling Method:** Hollow Stem Auger **Bit Size:** 8.25" OD (Cutting Diameter) **Auger Size:** 4.25" ID **Rig Type:** Diedrich D-50 **Sampling Method:** 2" and 3" OD x 2' Split Spoon	**Northing:** 1388727.25 **Easting:** 691655.85 **Casing Elevation:** 37.94 ft. AMSL **Borehole Depth:** 24' below grade **Surface Elevation:** 38.46 ft. AMSL **Geologist:** Dave Cornell	**Well/Boring ID:** MW-6 **Client:** Niagara Mohawk **Location:** Grand Street Non-Owned Former MGP Site Albany, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
	40									
0							NA			SAND, BRICK and CONCRETE. [FILL]
	35									
5		1	4-6	0.7	4 4 2 2	6	ND			Brown Silty fine to medium SAND, some fine to coarse subrounded Gravel, trace Brick, Ash, Cinders, non-plastic, moist. [FILL]
		2	6-8	1.4	4 1 1 1	2	ND			Trace Clay at 6.0' bgs.
	30	3	8-10	1.4	1 1 32 6	33	2.5	X		Black ORGANICS (Wood), organic odor, saturated. [FILL] Light gray Silty fine to coarse SAND, faint MGP odor, saturated. [FILL]
10		4	10-12	1.2	6 3 2 2	5	1.5			Gray Silty fine to coarse SAND and CINDERS, some Slag, fine to medium Gravel, little Organics, loose, non-plastic, saturated. [FILL] Dark Gray CINDERS and SLAG, little Ash, saturated. [FILL]
	25	5	12-14	1.0	2 2 3 4	5	1.1			Trace Brick at 12.0' bgs.
15		6	14-16	1.3	3 70/.5 NA NA	>50	1.8 29.6	X		Dark Brown ORGANICS (Wood), faint odor, saturated. Gray fine to medium SAND and fine to medium subangular GRAVEL, trace yellow oil, faint to moderate MGP odor, non-plastic, saturated.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod; ft. AMSL = feet above mean sea level.
Hand dug from 0 - 4.0' bgs.
Soil samples collected from 8.0' - 9.4' bgs (Also Dup-4 for PCB only) for VOCs, PAHs, PCB and Total CN; from 14.6' - 15.3' bgs for VOCs, PAHs, PCB and Total CN; and from 20.0' - 21.3' bgs for TOC.

Client:
Niagara Mohawk

Site Location:
Grand Street
Non-Owned
Former MGP Site

Well/Boring ID: MW-6

Borehole Depth: 24' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
		7	16-18	1.9	2 1 1 3	2	ND			Gray fine to medium SAND, some fine to medium subrounded Gravel, non-plastic, saturated. / Gray Silty CLAY, moderately plastic, wet. Interbedded with gray SILT, trace fine Sand, non-plastic, saturated.	2" 0.010 Slot Sch. 40 PVC Screen (8.0 - 18.0' bgs); #0 Silica Sand Pack (6.0' - 18' bgs)
	20	8	18-20	1.4	2 2 2 2	4	ND				2" PVC Sump (18' - 20' bgs); Grout (18' - 20' bgs)
20		9	20-22	1.3	WOR WOR 1 1	1	ND	X			
	15	10	22-24	2.0	1 1 1 2	2	ND				
25											
	10										
30											
	5										
35											

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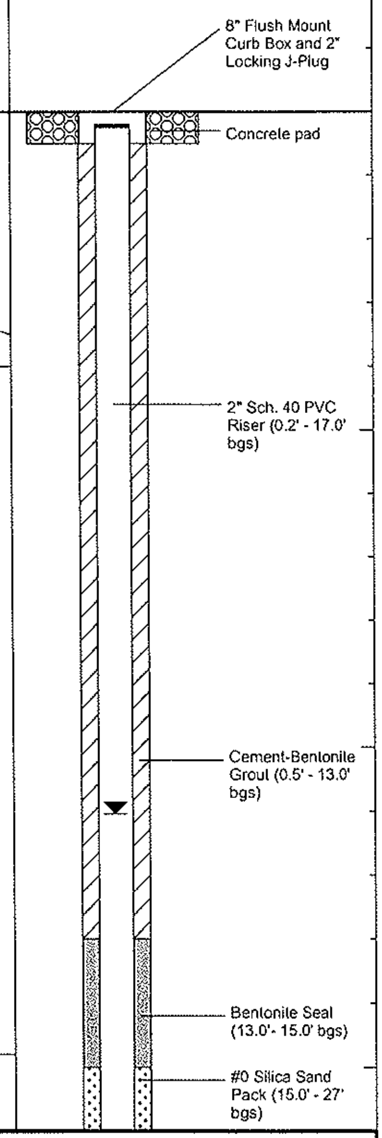
Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod; ft. AMSL = feet above mean sea level.
Hand dug from 0 - 4.0' bgs.
Soil samples collected from 8.0' - 9.4' bgs (Also Dup-4 for PCB only) for VOCs, PAHs, PCB and Total CN; from 14.6' - 15.3' bgs for VOCs, PAHs, PCB and Total CN; and from 20.0' - 21.3' bgs for TOC.

Date Start/Finish: 6/14/04-6/14/04 **Drilling Company:** Parratt-Wolff **Driller's Name:** R. Navatka and B. Palmer **Drilling Method:** Hollow Stem Auger **Bit Size:** 8.25" OD (Cutting Diameter) **Auger Size:** 4.25" ID **Rig Type:** Diedrich D-50 **Sampling Method:** 2" and 3" OD x 2' Split Spoon	**Northing:** 1388823.72 **Easting:** 691823.02 **Casing Elevation:** 37.40 ft. AMSL **Borehole Depth:** 29' below grade **Surface Elevation:** 37.70 ft. AMSL **Geologist:** Dave Cornell	**Well/Boring ID:** MW-7 **Client:** Niagara Mohawk **Location:** Grand Street Non-Owned Former MGP Site Albany, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Stratigraphic Description
	40								
0									Gray Silty fine to medium SAND and fine to coarse GRAVEL, little Cobbles, non-plastic, moist.
							ND		
	35								Brown Silty CLAY, non-plastic, moist.
									Brown SILT and CLAY, trace Root scars, moderately plastic, moist.
5		1	4-6	1.2	2 2 4 6	6	ND		
		2	6-8	1.9	8 8 10 10	18	ND		
	30								
		3	8-10	1.7	2 3 4 5	7	ND		
10									Trace fine Sandy SILT seams, moderately plastic, moist below 10' bgs.
		4	10-12	1.5	3 4 4 6	8	ND		
	25	5	12-14	1.9	4 5 7 8	12	ND		
15		6	14-16	2.0	2 2 3 6	5	ND	X	Brown-gray Silty CLAY, plastic, moist. Interbedded with fine Sandy SILT, non-plastic, saturated.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod; ft. AMSL = feet above mean sea level.
Hand dug from 0 - 4.0' bgs.
Soil samples collected from 14.0' - 16.0' bgs for PAHs, PCBs and Total CN; from 20.0' - 22.0' bgs for TOC; and from 24.0' - 26.0' bgs for VOCs, TCL, SVOCs, TAL inorganic constituents and Total CN.

Project: 36639.008
Data File:MW-7.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36639\Grandstreet.ldf
Date: 6/23/04

Client:
Niagara Mohawk

Site Location:
Grand Street
Non-Owned
Former MGP Site

Well/Boring ID: MW-7

Borehole Depth: 29' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	20	7	16-18	1.8	4 3 3 3	6	ND			Brown-gray Silty CLAY, plastic, moist. Interbedded with fine Sandy SILT, non-plastic, saturated.	2" Sch. 40 PVC Riser (0.2' - 17.0' bgs)
20		8	18-20	1.7	WOR 1 1 1	2	ND				
		9	20-22	2.0	1 1 1 3	2	ND	X			Cement-Bentonite Grout (0.5' - 13.0' bgs)
	15	10	22-24	2.0	1 1 1 2	2	ND				2" 0.010 Slot Sch. 40 PVC Screen (17.0 - 27.0' bgs)
25		11	24-26	2.0	1/1.0' NA 4 8	4	ND	X		Gray Silty CLAY, moderately plastic, wet to saturated. Gray Silty fine to coarse SAND, little Clay and fine to medium subrounded Gravel, slightly plastic, wet. [Till]	#0 Silica Sand Pack (15.0' - 27' bgs)
	10	12	26-28	1.0	NA 12 24 37	36	ND			Gray SILT and fine to medium SAND, some to little fine to medium subrounded Gravel, non-plastic, moist. [Till]	2" PVC Sump (27' - 29' bgs)
		13	28-30	NA	24 50/0.4	>50	ND			No Recovery.	Grout (27' - 29' bgs)
30											
	5										
35											

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod; ft. AMSL = feet above mean sea level.
Hand dug from 0 - 4.0' bgs.
Soil samples collected from 14.0' - 16.0' bgs for PAHs, PCBs and Total CN; from 20.0' - 22.0' bgs for TOC; and from 24.0' - 26.0' bgs for VOCs, TCL, SVOCs, TAL inorganic constituents and Total CN.

Date Start/Finish: 6/23/04-6/23/04
Drilling Company: Parratt-Wolff
Driller's Name: R. Navatka and B. Palmer
Drilling Method: Hollow Stem Auger
Bit Size: 8.25" OD (Cutting Diameter)
Auger Size: 4.25" ID
Rig Type: Diedrich D-50
Sampling Method: 2" and 3" OD x 2' Split Spoon

Northing: 1388525.68
Easting: 691797.46
Casing Elevation: 25.77 ft. AMSL

Borehole Depth: 28' below grade
Surface Elevation: 26.45 ft. AMSL

Geologist: Dave Cornell

Well/Boring ID: MW-8

Client: Niagara Mohawk

Location: Grand Street
Non-Owned Former MGP Site
Albany, NY

Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample
1	1-2	1.4	NA, 1, 2, 2	3	ND	
2	2-4	1.7	3, 4, 5, 5	9	ND	
3	4-6	2.0	3, 2, 4, 6	6	ND	
4	6-8	NA	7, 7, 6, 6	13	ND	
5	8-10	1.9	5, 5, 6, 7	11	ND	
6	10-12	2.0	2, 2, 3, 3	5	ND, 2024	X
7	12-14	1.1	3, 3, 2, 4	5	2705	
8	14-16	1.1	2, 3, 5, 5	8	35.7	

DEPTH: 0, 5, 10, 15 — ELEVATION: 25, 20, 15

Stratigraphic Description

CONCRETE.

SUBBASE.

Brown SILT and CLAY, trace Roots and Root scars, slightly plastic, moist.

No Recovery.

Brown Silty CLAY, trace Roots and Root scars, slightly plastic, moist.

Gray color, slightly plastic, saturated below 9.2' bgs.

Organics from 9.5' - 9.6' bgs, moist.

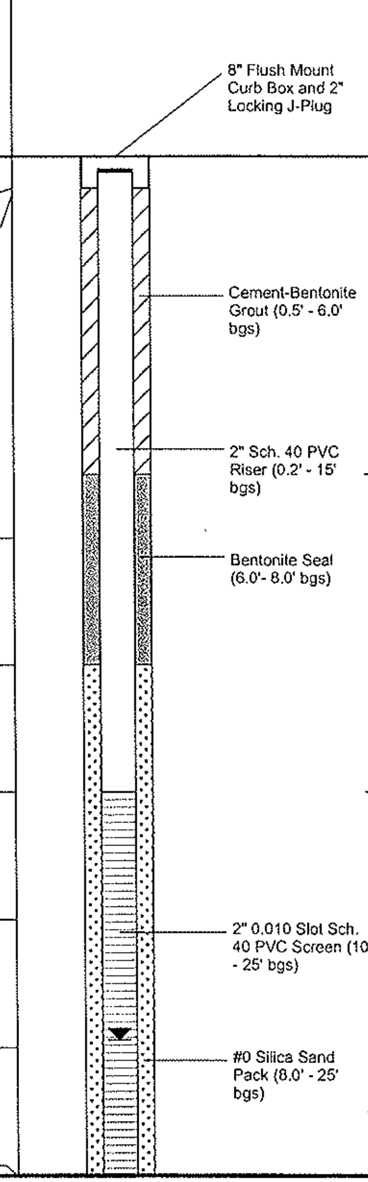
Brown-gray Silty CLAY, trace Gravel.

Trace Gravel, faint to moderate petroleum odor, wet below 11.3' bgs. Piece of Porcelain or Ceramic at 11.5' bgs. [FILL]

Brown-gray Silty CLAY, little Concrete, trace Brick and Gravel, slightly plastic, faint to moderate petroleum odor, moist to wet. [FILL]

Brown-gray Silty CLAY, trace Roots and Root scars, faint petroleum odor.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod.
Soil samples collected from 11.3' - 13.1' bgs for VOCs, TCL, SVOCs, TAL inorganic constituents, GRO, DRO and Total CN; and from 18.0' - 20.0' bgs for VOCs, PAHs, TOC and Total CN.

Client:
Niagara Mohawk

Site Location:
Grand Street
Non-Owned
Former MGP Site

Well/Boring ID: MW-8

Borehole Depth: 28' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
										Brown-gray Silty CLAY, trace Roots and Root scars, faint petroleum odor.
	10	9	16-18	2.0	3, 4, 5, 8	9	ND			Brown-gray Silty CLAY and fine to coarse angular GRAVEL, loose, non-plastic, wet.
20		10	18-20	2.0	7, 7, 7, 7	14	ND	X		Brown Silty CLAY and fine to coarse angular-subangular fine to coarse GRAVEL, trace fine to medium Sand, non-plastic. [Possible Till]
	5	11	20-22	2.0	2, 2, 4, 5	6	ND			Brown-gray Silty CLAY, mottled, moderately plastic, moist.
		12	22-24	0.2	2, 2, 3, 4	5	ND			
25		13	24-26	1.2	2, 2, 1, 1	3	ND			Gray Silty CLAY and fine to medium subangular GRAVEL, little fine to medium Sand, slightly plastic, wet. [Possible Till]
	0	14	26-28	1.4	4, 7, 30, 38	37	ND			Gray SILT, some fine to coarse subrounded Gravel, little fine Sand, non-plastic, moist. [Till]
30										
	-5									
35										

Well/Boring Construction

- #0 Silica Sand Pack (8.0' - 25' bgs)
- 2" 0.010 Slot Sch. 40 PVC Screen (10 - 25' bgs)
- SILT and CLAY (Native Natural Soils)

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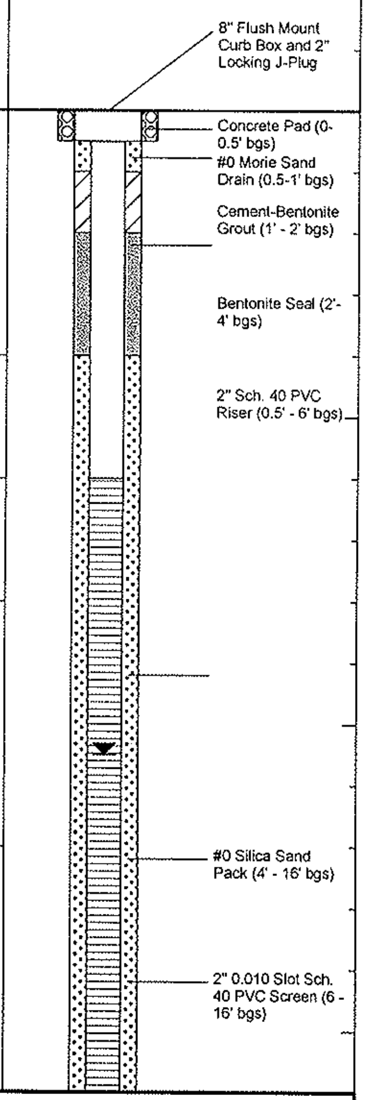
Remarks: bgs = below ground surface; NA = Not Applicable/Available; ND = Not detected; WOR = Weight of Rod.
Soil samples collected from 11.3' - 13.1' bgs for VOCs, TCL, SVOCs, TAL inorganic constituents, GRO, DRO and Total CN; and from 18.0' - 20.0' bgs for VOCs, PAHs, TOC and Total CN.

Date Start/Finish: 5/12/05 **Drilling Company:** Parratt-Wolff **Driller's Name:** R. Navatka/M. Marshall **Drilling Method:** Hollow Stem Auger **Bit Size:** 8.25" OD (Cutting Diameter) **Auger Size:** 4.25" ID **Rig Type:** CME 75 **Sampling Method:** 2" OD x 2' Split Spoon	**Northing:** 1388699.12 **Easting:** 691583.88 **Casing Elevation:** 40.03 **Borehole Depth:** 18' below grade **Surface Elevation:** 40.51 **Geologist:** Katherine Murray	**Well/Boring ID:** MW-9 **Client:** Niagara Mohawk A National Grid Company **Location:** Grand Street Non-Owned Former MGP Site Albany, NY

DRAFT

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	40	1	1-2	NA	- - - -	NA	NA			Brown fine to coarse SAND, some fine Gravel, nonplastic, dry to damp. [FILL]
		2	2-4	NA	- - - -	NA	NA			
5	35	3	4-6	0.9	2 6 50/0.3 -	NA	0.0			Red/white BRICK fragments, some to little fine Gravel, trace fine to coarse Sand, nonplastic, dry.
		4	6-8	NA	- - - -	NA	NA			No recovery - refusal.
		5	8-10	0.4	2 2 2 2	4	0.0			Gray SILT, little Clay, trace fine Gravel and fine to coarse Sand, plastic, moist.
10	30	6	10-12	2.0	2 2 3 4	5	0.0	X		No gravel, moist to wet.
		7	12-14	0.6	7 6 7 6	13	0.0			Gray SILT, trace Clay, slightly plastic, saturated.
15	25	8	14-16	2.0	2 4 7 5	11	0.0			

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; SS = Split Spoon. Soil samples collected from 10-12' bgs for TCL VOCs, TCL SVOCs, TAL Metals, and Total CN.

Client: Niagara Mohawk
A National Grid Company

Well/Boring ID: MW-9

DRAFT

Site Location:
Grand Street
Non-Owned
Former MGP Site

Borehole Depth: 18' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
		9	16-18	2.0	2 4 7 7	11	0.0			Interbedded brown and blue-gray CLAY, some Silt, plastic, saturated.	2" Sch. 40 PVC Sump (16' - 18' bgs); CLAY (Native Natural Soils)
20	20										
25	15										
30	10										
35	5										

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; SS = Split Spoon. Soil samples collected from 10-12' bgs for TCL VOCs, TCL SVOCs, TAL Metals, and Total CN.

Date Start/Finish: 5/11/05
Drilling Company: Parratt-Wolff
Driller's Name: R. Navatka/M. Marshall
Drilling Method: Hollow Stem Auger
Bit Size: 8.25" OD (Cutting Diameter)
Auger Size: 4.25" ID
Rig Type: CME 75
Sampling Method: 2" OD x 2' Split Spoon

Northing: 1388622.58
Easting: 691719.56
Casing Elevation: 36.91

Borehole Depth: 24' below grade
Surface Elevation: 37.28

Geologist: Katherine Murray

Well/Boring ID: MW-10

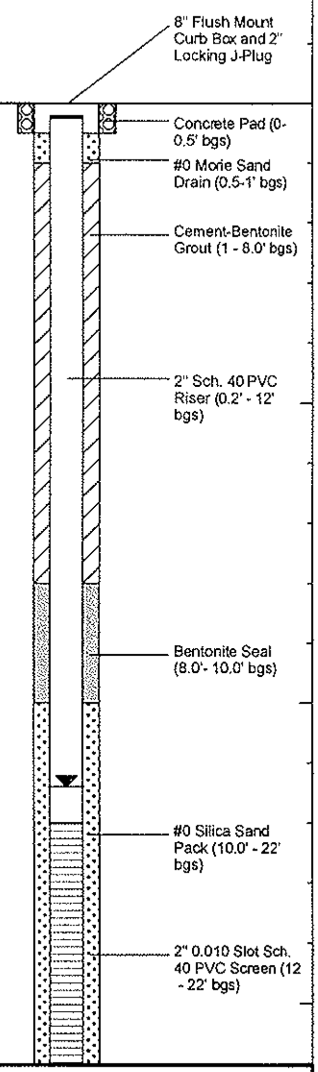
DRAFT

Client: Niagara Mohawk
A National Grid Company

Location: Grand Street
Non-Owned Former MGP Site
Albany, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
	40									
0		1	1-2	NA	NA NA NA NA	NA	NA			Hand-dig to 4' bgs for utility check. Brown fine to medium SAND, little fine Gravel, dense, nonplastic, dry. [FILL]
	35	2	2-4	NA	NA NA NA NA	NA	NA			
5		3	4-6	0.3	15 17 50/0.3 -	NA	0.0			Brown fine to medium SAND, little fine Gravel, trace Brick, Cinder, and Concrete fragments, dense, nonplastic. [FILL]
	30	4	6-8	NR	- - - -	NA	NA			Refusal - no recovery. Auger to 10' bgs below holder floor.
		5	8-10	NA	- - - -	NA	NA			
10		6	10-12	1.7	2 2 3 3	5	0.5/ 0.3	X		Brown-gray SILT, trace Clay and fine Sand, nonplastic, faint odor at 11.0 bgs, moist to wet at 11.5' bgs.
	25	7	12-14	1.7	5 5 6 6	11	22/ 7.7/ 2.9	X		Brown SILT, trace Clay, slightly plastic, faint odor, wet.
15		8	14-16	2.0	4 4 5 4	9	0.4/ 1.9/ 0.0			Brown SILT, little Clay, trace fine Sand, faint odor, slightly plastic, wet.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; SS = Slit Spoon..
Soil samples collected from 10-12' and 12-14' bgs for TCL VOCs, TCL SVOCs, TAL Metals, and Total CN. MS/MSD taken 10-12' bgs.
PID headspace measurements taken every 0.5' where positive readings encountered.

Client: Niagara Mohawk
A National Grid Company

Well/Boring ID: MW-10

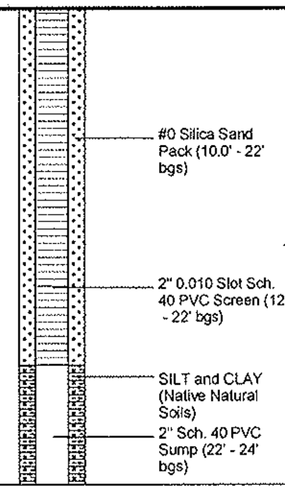
DRAFT

Site Location:
Grand Street
Non-Owned
Former MGP Site

Borehole Depth: 24' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
	20	9	16-18	2.0	6 7 10 12	17	1.6/ 0.2			Brown interbedded fine SAND and SILT with SILT and CLAY layers, faint odor, slightly plastic, to moderately plastic, saturated.
		10	18-20	2.0	7 4 4 5	8	0.0			
20		11	20-22	2.0	7 4 3 4	7	0.8			
	15	12	22-24	2.0	2 2 2 2	4	0.0			Gray Pushed 3" SS 2' to set sump in natural Silty Clay soils.
25										
	10									
30										
	5									
35										

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; SS = Slit Spoon..
Soil samples collected from 10-12' and 12-14' bgs for TCL VOCs, TCL SVOCs, TAL Metals, and Total CN. MS/MSD taken 10-12' bgs.
PID headspace measurements taken every 0.5' where positive readings encountered.

Date Start/Finish: 9/8/05 - 9/9/05 **Drilling Company:** Parratt-Wolff **Driller's Name:** Lee Penrod **Drilling Method:** Geoprobe/HSA **Bit Size:** 8.25" OD (Cutting Diameter) **Auger Size:** 4.25" ID **Rig Type:** IR-A300 **Sampling Method:** 2" OD x 2' Split Spoon	**Northing:** 1388999.66 **Easting:** 691563.37 **Casing Elevation:** 59.34 **Borehole Depth:** 24' below grade **Surface Elevation:** 60.03 **Geologist:** Katherine Murray	**Well/Boring ID:** MW-14 **DRAFT** **Client:** Niagara Mohawk A National Grid Company **Location:** Grand Street Non-Owned Former MGP Site Albany, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
											8" Flush Mount Curb Box and 2" Locking J-Plug
0	60									CONCRETE. Auger with drill bit.	Concrete Pad (0-1' bgs)
		1	0-4	NA	NA	NA	NA			Hand auger to 4' bgs. Brown fine to coarse SAND, some fine Gravel, trace Silt, loose, dry.	#0 Morie Sand Drain (0.75 - 2' bgs); Bentonite/Concrete Grout (2 - 8' bgs)
5	55	2	4-6	2.0	- - - -	NA	0.0			Tan/gray Silty CLAY, hard, low to moderate plasticity, damp.	2" Sch. 40 PVC Riser (0.5 - 12' bgs)
		3	6-8	2.0	- - - -	NA	0.0				
		4	8-10	2.0	- - - -	NA	0.0			Brown Silty CLAY, hard, plastic, moist.	Bentonite Seal (8 - 10' bgs)
10	50	5	10-12	2.0	- - - -	NA	0.0				#0 Silica Sand Pack (10 - 22' bgs)
		6	12-14	2.0	- - - -	NA	0.0				
15	45	7	14-16	2.0	- - - -	NA	0.0	X			2" 0.010 Slot Sch. 40 PVC Screen (12 - 22' bgs)

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; SS = Split Spoon; HSA = Hollow Stem Auger.
Soil samples collected from 14-16' bgs (with duplicate) and 20-22' bgs (with MS/MSD) for TCL VOCs, TCL SVOCs, TAL Metals, and Total CN.

Project: 36639.011
Data File:MW-14.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36639\Grandstreet.ldf
Date: 9/22/05

Client: Niagara Mohawk
A National Grid Company

Well/Boring ID: MW-14

DRAFT

Site Location:
Grand Street
Non-Owned
Former MGP Site

Borehole Depth: 24' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
		8	16-18	2.0	- - - -	NA	0.0			Brown Silty CLAY, hard, plastic, moist.	2" 0.010 Slot Sch. 40 PVC Screen (12 - 22' bgs)
		9	18-20	2.0	- - - -	NA	0.0			Gray Silty CLAY, hard, plastic, wet.	
20	40	10	20-22	2.0	- - - -	NA	0.0	X			#0 Silica Sand Pack (10 - 22' bgs)
		11	22-24	2.0	- - - -	NA	0.0				Bentonite Backfill (22 - 24' bgs)
25	35										
30	30										
35	25										

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; SS = Split Spoon; HSA = Hollow Stem Auger.
Soil samples collected from 14-16' bgs (with duplicate) and 20-22' bgs (with MS/MSD) for TCL VOCs, TCL SVOCs, TAL Metals, and Total CN.

ARCADIS

Appendix G

Field Sampling Plan

Imagine the result

Appendix G

Field Sampling Plan

Albany (Grand Street)
Non-Owned Former MGP Site
Albany, New York

June 2012

Attachments

1. Introduction

1.1 General

This Field Sampling Plan (FSP) supports the Site Management Plan (SMP) for the Albany (Grand Street) non-owned former manufactured gas plant (MGP) site (the "Site") located on the east side of Grand Street in Albany, New York. This FSP presents field investigation and sampling procedures to be conducted during implementation of ongoing monitoring activities at the Site. Related documents include the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP), which are included in the SMP.

1.2 Monitoring Objectives

The monitoring and sampling of groundwater will be conducted to achieve the following objectives:

- Evaluate the groundwater quality of the overburden fill.
- Evaluate the groundwater flow pattern.
- Evaluate the groundwater concentrations of Constituents of Concern (COCs).
- Confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

1.3 Overview of Ongoing Sampling Activities

Field sampling efforts which will be conducted to obtain information necessary to meet the monitoring objectives will include annual groundwater sampling activities.

The rationale for the field sampling investigation is provided in detail in the SMP. A site location map is included on Figure 1 in the SMP. The location of physical features at the site and the groundwater sampling locations are shown on Figures 2 and 16 in the SMP. Further detail regarding the field sampling investigation is provided in Section 2 of this FSP.

2. Field Sampling

2.1 General

This section presents detailed information for conducting groundwater sampling activities as part of the ongoing Site management activities at the Site. The following information is provided for the groundwater sampling investigation:

- Procedures for collecting samples, measuring groundwater field parameters (i.e., pH, conductivity, depth to groundwater, dissolved oxygen, organic vapors, temperature, turbidity)

- A summary of the data to be generated from the sampling efforts.

Detailed information regarding the frequency of quality assurance/quality control (QA/QC) samples to be collected and the corresponding parameters to be analyzed during the ongoing Site management activities are presented in Table 1. Information regarding the sample containers, preservation, and holding times for samples is presented in Table 2. Detailed sample collection procedures are provided Attachments A through C of this FSP.

2.2 Task 1 - Groundwater Monitoring/Sampling

The groundwater sampling activities will consist of the following subtasks:

- Measuring groundwater levels at each monitoring well in the vicinity of the former MGP site

- Collecting groundwater samples from each monitoring well in the vicinity of the former MGP site for laboratory analysis.

A detailed description of the field activities to be conducted as part of the groundwater sampling activities is presented in the SMP and summarized below.

2.2.1 Subtask 1.1 – Groundwater Level Measurements

Groundwater level measurements will be obtained from seven monitoring well locations including MW-5, MW-6, MW-7, MW-8A, MW-9, MW-10 and MW-14, prior to collecting groundwater samples. Groundwater levels at each well will be measured to the nearest one-hundredth of a foot from the reference point at the top of the inner well casing using the procedures described in Attachment C. The measurements will be converted to elevations (referenced to a site-specific datum).

2.2.2 Subtask 1.2 – Groundwater Sampling

One round of groundwater samples will be collected from seven monitoring well locations including MW-5, MW-6, MW-7, MW-8A, MW-9, MW-10 and MW-14 using the purging and sampling techniques in accordance the sampling protocol discussed in Attachment C. Samples will be submitted to a certified analytical laboratory for laboratory analysis for Target Compound List (TCL) volatile organic compounds (VOCs) using the NYSDEC ASP analytical methods. QA/QC samples (including trip blank, field duplicate, matrix spike, and matrix spike duplicate samples) will be collected and submitted for laboratory analysis, as referenced in the QAPP.

Groundwater samples will be placed into appropriate sample containers as described in Section 4 and sample containers will be labeled as described in Section 3. The samples will be handled, packaged, and shipped following the procedures in Section 4 and Attachment A.

3. Sample Designation System

A sample designation code and the sample date will provide each sample with a unique “name”. This alphanumeric system will apply to all soil, soil-gas, groundwater, and sediment samples which are collected and submitted for laboratory analysis. The sample designation code system includes a letter prefix describing the sample matrix and a number indicating the sample location. Letter prefixes that will be used for the sample designation code system are as follows:

- Groundwater – “MW”

The sample location number will be assigned by the field sampling personnel prior to each sampling event. Rinse blank, trip blank, and blind duplicate samples will be designated as follows:

- Rinse Blank – “RB”
- Trip Blank – “TB”
- Blind Duplicate – “DUP”

Multiple rinse blank, trip blank, and blind duplicate samples will be distinguished by adding a numeric suffix which is preceded by the letter code and a hyphen (i.e., RB-1, RB-2, etc.). Additional sample volumes collected for matrix spike (“MS”) and matrix spike duplicate (“MSD”) analysis will be noted on the chain-of-custody forms, and the associated additional sample containers will be labeled, as described above, with the appropriate suffix (“MS” or “MSD”).

4. Sample Handling and Documentation

4.1 Sample Containers and Preservations

Appropriate sample containers, preservation methods, and laboratory holding times for groundwater samples are presented in Table 2.

Appropriate sample containers will be provided by the certified analytical laboratory in sealed cartons, as well as sample labels and preservatives. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are described in Attachment A.

4.2 Packing, Handling, and Shipping Requirements

Sample custody seals and packing materials for filled sample containers will also be provided by the certified analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to minimize the possibility of container breakage.

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

4.3 Documentation

Field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and sample chain-of-custody. This documentation constitutes a record which allows reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the field work will be retained in the project file.

The various forms of documentation to be maintained include:

- Daily Production Documentation - A field notebook consisting of a waterproof, bound notebook which will contain a record of all activities performed at the site.

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

- Sample Chain-of-Custody - Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Chain-of-custody forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by one of the field personnel designated to be responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the chain-of-custody form will be signed and dated by the appropriate personnel to document the sample transfer. The original chain-of-custody form will accompany the samples to the laboratory and copies will be forwarded to the project files. Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

- Field Equipment, Calibration, and Maintenance Logs - To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment (which is not factory calibrated). Calibration procedures and calibration and maintenance logs are provided in Attachment D.

4.4 Management of Investigation-Derived Materials and Wastes

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

4.4.1 Excess Ground Water

Development water purged water from the monitoring wells will be placed into Department of Transportation- (DOT-) approved steel 55-gallon drums. The liquid waste will be disposed by National Grid in accordance with applicable regulations following completion of the groundwater sampling activities.

4.4.2 Disposable Equipment and Debris

Disposable equipment and debris, such as health and safety equipment, plastic sheeting, sampling equipment, and other equipment not reused in the investigation will be collected in plastic bags during the sampling events and placed into DOT-approved steel drums, which will be stored in a suitable onsite location. The waste materials will be disposed by National Grid in accordance with applicable regulations.

4.4.3 Decontamination Rinsate

Field sampling equipment will be decontaminated by following the procedures outlined in Attachment B. Decontamination rinsate will be containerized at each sampling location or group of locations. Upon completion of the field activities, the rinsate will be containerized in a steel drum or polyethylene tank for storage in a suitable onsite location prior to offsite disposal by National Grid in accordance with applicable regulations.

5. Quality Assurance/Quality Control

This section summarizes the QA/QC requirements for field investigation activities associated with the groundwater sampling activities.

5.1 Field Instrument Calibration and Preventative Maintenance

Field personnel will be responsible for assuring that a master calibration/maintenance log is maintained (following procedures specified in Attachment D) for each measuring device. Each log will include at a minimum (where applicable):

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

Equipment to be used each day shall be calibrated prior to the commencement of the day's activities or as suggested by the manufacturer.

Health and safety monitoring equipment (i.e., meter to measure total organic vapors, oxygen, carbon monoxide, hydrogen sulfide, and combustible gas) and water quality testing equipment (pH, conductivity, dissolved oxygen, and temperature meters) will be calibrated and maintained in accordance with the manufacturer's specifications.

5.2 QA/QC Sample Collection

The frequency of QA/QC field samples to be collected is provided in Table 1. This estimate is based on the QA/QC sample collection frequency as discussed in the QAPP. Guidance on the collection of the QA/QC samples is presented below.

<u>Trip Blanks</u>

On events/days of aqueous volatile sampling, a trip blank will be collected. A trip blank is an aliquot of analyte-free water which is sealed in 40-millimeter (ml) glass vials with Teflon™-lined septum caps prior to initiation of field work. This blank is applied in sample validation to determine if any cross-contamination has occurred between samples during shipment. These sealed bottles will be prepared and included with each shipment of sample bottles for aqueous media to and from the lab site.

Rinse Blanks

Rinse blanks will be prepared by pouring analyte-free water over decontaminated sampling equipment as a check that the decontamination procedure has been adequately performed and that cross contamination of samples will not occur due to the equipment. One rinse blank will be collected for each type of decontaminated equipment used each day. Rinse blanks will be performed on sampling equipment and other equipment such as bowls or pans used to homogenize samples. The same aliquot of rinse water may be used on all equipment coming in contact with a particular matrix for analysis for SVOCs and inorganic constituents. A separate rinse blank must be collected for each piece of equipment used for a particular sample matrix to be analyzed for VOCs. Rinse blanks will be collected at the beginning of the day before the sampling event and must accompany the samples collected that day.

Rinse blanks will be prepared in the field. Laboratory-supplied analyte-free water will be poured into or over the sampling equipment and then directly into the laboratory-supplied sample bottles. The intent is for the water making up the blank to follow the same path, and therefore, come in contact with the same equipment as the samples.

Duplicate Samples

Duplicate samples will be sent for laboratory analysis to evaluate the reproducibility of the sampling technique used. Five percent (i.e., one for every 20 samples) of each matrix will be duplicated.

Duplicate samples will be collected using methods to maximize the compatibility of the samples. For example, groundwater contained in a bailer retrieved from a monitoring well will be divided between the sample and duplicate sample laboratory containers.

Matrix Spike/Matrix Spike Duplicate

Triple sample volumes from designated sample locations will be collected for each matrix in order to perform matrix spike/matrix spike duplicate analysis. Table 1 sets forth the frequency of collection for matrix spike/matrix spike duplicates.

TABLE 1

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

FIELD SAMPLING PLAN

ESTIMATED QUANTITY OF ENVIRONMENTAL AND QUALITY CONTROL SAMPLES

Parameters	Estimated Environmental Sample Quantity	Field QC Analysis						Laboratory QC Analysis								Estimated Total (Per Year)
		Trip Blank		Field Duplicate		Rinse Blank		MS		MSD		MSB		Lab Duplicate		
		Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Groundwater Sampling																
TCL VOCs	7	1/day	3	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	--	--	15
Waste Characterization Sampling																
PCBs	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP VOCs	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP SVOCs	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP Inorganics	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Reactivity	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Corrosivity	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ignitability	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1

Notes:

1. Abbreviations used in this table and the corresponding terms are listed below:
   A. MSD - matrix spike duplicate
   B. MSB - matrix spike blank
   C. QC - quality control
   D. PCBs - polychlorinated biphenyls
   E. TCL - target compound list
   F. VOCs - volatile organic compounds
   G. SVOCs - semi-volatile organic compounds
   H. TAL - target analyte list
   I. USEPA - United States Environmental Protection Agency
   J. TCLP - toxicity characteristic leaching procedure
   K. TOC - total organic carbon
2. 1/day - One trip blank per day of volatile organic sampling media. One rinse blank per day of sampling with sampling device which requires field-cleaning. Dedicated sampling equipment will be used to collect subsurface soil and groundwater samples.
3. Table assumes that samples will be processed in groups of 20 samples for QC analyses. If smaller groups are processed, then one MS/MSD (or MS/lab duplicate) per sample delivery group (up to 20 samples) will be prepared for each sample delivery group.
4. NYSDEC 2005 ASP (or latest version) guidelines will be used for the laboratory analyses of the following constituents:
   A. TCL VOCs: USEPA SW-846 Method 8260
   B. TCL SVOCs: USEPA SW-846 Method 8270
   C. TAL Inorganic Constituents: USEPA SW-846 Method 6010 with the following exceptions: mercury will be analyzed using Method 7470/7471 and cyanide will be analyzed using Method 9010.
   D. TOCs: Lloyd Kahn method.

TABLE 2

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

FIELD SAMPLING PLAN

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Method	Bottle Type	Preservation	Holding Time
Water Samples				
TCL VOCs	8260	(2) 40 mL glass vials with Teflon-lined lid	HCl to pH<2, Cool to 4°C	14 days to analysis
Waste Characterization Samples				
TCLP VOCs	1311 / 8260	(1) 125 mL widemouth glass container, cap lined	Cool to 4°C	14 days to analysis
TCLP SVOCs	1311 / 8270	(1) 250 mL widemouth glass container, cap lined with Teflon	Cool to 4°C	14 days to analysis
TCLP Metals	1311 / 6010 / 7470		Cool to 4°C	14 days to analysis
Reactivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Corrosivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Ignitability	SW-846 Chapter 7		Cool to 4°C	No holding time
PCBs	8082		Cool to 4°C	14 days to extraction 40 days to analysis

Notes:
1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*
2. All holding times are measured from date of collection.
3. NS - Not Specified
4. NA - Not Applicable

Tables

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Attachment A

Sample Packing, Handling and Shipping Procedures

Attachment A – Sample Packing, Handling, and Shipping Procedures

1.1 Introduction

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

1.2 Equipment and Materials

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

1.3 Sample Handling Procedures

1. Fill in sample label (Exhibit B-1) with:
   a. Sample matrix (soil, groundwater, etc.);
   b. Project number and site name;
   c. Sample identification code and other sample identification information, if applicable;
   d. Analysis required;
   e. Date sampled;
   f. Time sampled;
   g. Name, affiliation, and contact phone number;
   h. Sample type (composite or grab); and
   i. Preservative added, if applicable.
2. Cover the label with clear packing tape to secure the label onto the container.

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

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

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

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

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

1.4 Sample Packing Procedures

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

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

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

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

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

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

7. Place the completed chain-of-custody forms (Exhibit B-3) in a large Ziploc-type bag and tape the forms to the inside of the cooler lid.

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

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

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

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

1.5 Sample Shipping Procedures

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

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

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

   b. When the samples are received by the laboratory, the laboratory personnel shall complete the chain-of-custody forms by recording receipt of samples, measure and record the internal temperature of the shipping container, and then check the sample identification numbers on the containers to the chain-of-custody forms.

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Attachment B

Equipment Decontamination and Cleaning Procedures

Attachment B – Equipment Decontamination and Cleaning Procedures

1.1 Introduction

This attachment presents procedures which will be used to decontaminate equipment used to collect groundwater samples. In addition, this attachment presents the procedures to be followed in cleaning equipment used to install monitoring wells. The adequacy of cleaning procedures will be monitored through the collection of QA/QC rinse blank samples which will be submitted for laboratory analysis.

1.2 Sampling Equipment Decontamination

Generally, dedicated sampling equipment will be used during the investigations (i.e., stainless-steel trowels, groundwater sample bailers). However, equipment that is not dedicated (i.e., split-spoon sampler) will be decontaminated prior to each use to mitigate the potential for cross-contamination of the samples collected for laboratory analysis. The decontamination procedures to be utilized during the investigation are presented below:

<u>For VOC, SVOC, and Inorganic Sampling</u>

1. Non-phosphate detergent solution wash.
2. Tap water rinse.
3. Citrus-based degreaser wash (if necessary).
4. Tap water rinse.
5. Non-phosphate detergent solution wash.
6. Tap water rinse.
7. 10 percent nitric acid rinse.
8. Distilled water rinse.
9. Methanol rinse.
10. Distilled water rinse.
11. Allow to air-dry.

1.3 Drilling and Excavation Equipment Cleaning

In addition to the above-discussed decontamination procedures, the drilling rig and all downhole equipment associated with the drilling of soil borings and the installation of monitoring wells will be steam cleaned prior to arrival on site and between each drilling location.

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Attachment C

Fluid Level Measurement and Sampling Procedures for Monitoring Wells

Attachment C – Fluid Level Measurement and Sampling Procedures for Monitoring Wells

1.1 Introduction

This attachment describes the procedures to be used to measure water levels in monitoring wells and collect groundwater samples. During precipitation events, groundwater sampling will be discontinued until precipitation ceases. When a round of water levels is taken for the purpose of generating water elevation data, the water levels will be taken consecutively at one time prior to sampling or other activities.

1.2 Materials

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

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

1.3 Procedures

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

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

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

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

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

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

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

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

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

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

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

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

12. Purge the well a minimum of three well volumes using a bottom-loading polyethylene bailer. The bailer will be lowered into the screened portion of the well to retrieve a filled bailer from the well causing minimal disturbance to the water and any sediments in the well.

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

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

    If the field parameters have not stabilized after a reasonable effort has been made during the well purging, a sample will be collected based on the judgment of the field personnel. If the field parameters have stabilized, but the turbidity of the groundwater is not less than the 50 NTU goal, purging will continue until the 50 NTU turbidity goal is achieved or, if not possible, until reasonable effort has been made to reduce the turbidity to less than 50 NTUs.

14. After the appropriate purge volume of groundwater in the well has been removed, obtain the groundwater sample for analysis for VOCs from the sampling device. Groundwater samples will be placed directly into the appropriate containers. When sampling for volatiles, collect water samples directly from a bottom-loading bailer into 40-mL vials with Teflon-lined septa. The bailer will be slowly lowered into the screened portion of the well to retrieve a filled bailer from the well causing minimal disturbance to the water and any sediments in the well.
15. Secure the caps on the sample containers. Place the sample containers on ice in an insulated transport container provided by the laboratory.

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

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

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

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

20. Complete the procedures for packaging, shipping, and handling.

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

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Attachment D

Calibration Procedures

Attachment D – Calibration, Operation, and Maintenance Procedures for Field Investigation Activities

1. Attachment D-1 - Photoionization Detector Calibration, Operation and Maintenance Procedures

1.1 Introduction

Field screening with a photoionization detector (PID) (HNU meter) is a procedure to measure relative concentrations of volatile organic compounds (VOCs) and other compounds. The characteristics of the PID are presented in Exhibit K-1.1. Compounds which the PID can detect are presented in Exhibit K-1.2. The PID will be used for field screening the following:

- The work area air to assess exposure to on-site workers of air contaminants via the air pathway;
- The headspace at each well as a precautionary measure each time the well cover is opened; and
- The headspace of soil samples to assess the relative concentration of volatile organic compounds in the samples.

1.2 Materials

The following materials, as required, shall be available while performing PID field screening:

- Appropriate PPE (as required by the Health and Safety Plan)
- PID and operating manual
- Isobutylene calibration gas tank with pressure regulator
- Plastic tubing to connect the PID probe to the calibration gas tank
- Sample jars
- Aluminum foil
- Field notebook
- PID calibration log

1.3 PID Calibration

PID field instruments will be calibrated and operated to yield “total organic vapor” in ppm (v/v) as benzene. Operation, maintenance, and calibration shall be performed in accordance with the manufacturers instructions and entered on the PID calibration and maintenance log (Exhibit K-1.3).

1. Don appropriate PPE (as required by the Health and Safety Plan);

2. Turn the FUNCTION switch to the BATTERY CHECK position. Check that the indicator is within or beyond the green battery arc. If indicator is below the arc or the red LED is lit, the battery must be charged.

3. Turn the FUNCTION switch to the STANDBY position and rotate the ZERO POTENTIOMETER until the meter reads zero. Wait 15 to 20 seconds to confirm the adjustment. If unstable, readjust.

4. Check to see that the SPAN POTENTIOMETER is adjusted for the probe being used (e.g., 9.8 for 10.2 eV).

5. Set the FUNCTION switch to the desired ppm range (0-20, 0-200, or 0-2,000). A violet glow from the UV source should be visible at the sample inlet of the probe/sensor unit.

6. Listen for the fan operation to verify fan function.

7. Connect one end of the sampling hose to the calibration canister regulator outlet and the other end to the sampling probe of the PID. Crack the regulator valve and take a reading after 5 to 10 seconds. Adjust the span potentiometer to produce the concentration listed on the span gas cylinder. Record appropriate information on the field calibration log (Exhibit K-1.3 or equivalent).

8. If so equipped, set the alarm at desired level.

1.4 Work Area Air Monitoring Procedure

1. Measure and record the background PID reading.

2. Measure and record breathing space reading.

1.5 Well Headspace Screening Procedure

1. Measure and record the background PID reading.

2. Unlock and open the well cover while standing upwind of the well.

3. Remove the well cap.

4. Place the PID probe approximately 6 inches above the top of the casing.

5. Record all PID readings and proceed in accordance with the site Health and Safety Plan.

1.6 Maintenance Procedures

1. At the end of each day of after 8 hours of monitoring with the PID, recharge the batteries for 12 hours.

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

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

4. After use, the instrument will be inspected and the inspection recorded in the field notebook.

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

6. The PID will be sent back to the manufacturer for service, if needed.

7. Record calibration information on PID Calibration and Maintenance Log (Exhibit K-1.3).

1.7 Equipment Cleaning

After each use, the readout unit should be wiped down with a clean cloth or paper towel. The UV light source window and ionization chamber should be cleaned in the following manner once a month:

1. With the PID off, disconnect the sensor/probe from the unit.
2. Remove the exhaust screw, grasp the end cap in one hand and the probe shell in the other, and pull apart.
3. Loosen the screws on the top of the end cap, and separate the end cap and ion chamber from the lamp and lamp housing.
4. Tilt the lamp housing with one hand over the opening so that the lamp slides out into your hand.
5. Clean the lamp with lens paper and HNU cleaning compound (except 11.7 eV). For the 11.7 eV lamp, use a chlorinated organic solvent.
6. Clean the ion chamber using methanol on a cotton swab and then dry gently at 50ºC to 60ºC for 30 minutes.
7. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place ion chamber on top of the housing, making sure the contacts are properly aligned.
8. Place the end cap on top of the ion chamber and replace the two screws, tighten the screws only enough to seal the o-ring.
9. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell.

Exhibit K -1.1
CHARACTERISTICS OF THE PHOTOIONIZATION DETECTOR (PID)

1.1 Introduction

Photoionization detectors (PIDs) are used in the field to detect a variety of compounds in air. PIDs can be used to detect leaks of volatile substances in drums and tanks, to determine the presence of volatile compounds in soil and water, and to make ambient air surveys. If personnel are thoroughly trained to operate the instrument and to interpret the data, these PID instruments can be a valuable tool. Its use can help in deciding the level of protection to be worn, assist in determining the implementation of other safety procedures, and in determining subsequent monitoring or sampling locations.

Portable PIDs detect the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which ionizes molecules that have an ionization potential (IP) less than or equal to that rated for the UV source. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, thus yielding a positively charged ion and the free electron. These ions are attracted to an oppositely charged electrode, causing a current and an electric signal to the LED display. Compounds are measured on a parts per million (ppm) volume basis.

1.2 HNU PI-101

The HNU portable photoionizer detects the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to UV radiation, which is energetic enough to ionize many gaseous compounds. Each molecule is transformed into charged ion pairs, creating a current between two electrodes. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, yielding a positively charged ion and the free electron.

Three probes, each containing a different UV light source, are available for use with the HNU. Energies are 9.5, 10.2, and 11.7 electron volts (eV), respectively. All three probes detect many aromatic and large-molecule hydrocarbons.

The 10.2 eV and 11.7 eV probes, in addition, detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2 eV probe is the most useful for environmental response work, as it is more durable that the 11.7 eV probe and detects more compounds than the 9.5 eV probe. The 10.2 eV probe will be used for all PID screenings related to field activities at this site. A listing of molecules and compounds that the HNU can detect is presented in Exhibit K-1.2.

The primary HNU calibration gas is either benzene or isobutylene. The span potentiometer knob is turned to 9.8 for benzene calibration. A knob setting of zero increases the sensitivity to benzene approximately tenfold. Its lower detection limit is in the low ppm range. Additionally, response time is rapid; the dot matrix liquid crystal displays 90 percent of the indicated concentration in three seconds.

1.3 Limitations

The PID instrument can monitor several vapors and gases in air. Many non-volatile liquids, toxic solids, particulates, and other toxic gases and vapors, however, cannot be detected with PIDs. Since the PIDs cannot detect all the chemicals that may be present at a sample location, a zero reading on either instrument does not necessarily signify the absence of air contaminants.

The PID instrument is generally not specific, and their response to different compounds is relative to the calibration gases. Instrument readings may be higher or lower than the true concentration. This effect can be observed when monitoring total contaminant concentrations if several different compounds are being detected at once. In addition, the response of these instruments is not linear over the entire detection range. Therefore, care must be taken when interpreting the data. Concentrations should be reported in terms of the calibration gas and span potentiometer or gas-select-knob setting.

PIDs are small, portable instruments and may not yield results as accurate as laboratory instruments. PIDs were originally designed for specific industrial applications. They are relatively easy to use and interpret when detecting total concentrations of known contaminants in air, but interpretation becomes more difficult when trying to identify the individual components of a mixture. Neither instrument can be used as an indicator for combustible gases or oxygen deficiency.

This FSP intends for the PIDs to be used only as a guide for work area air monitoring to establish action levels (as defined in the Health and Safety Plan).

Exhibit D-1.2
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Some Atoms and Simple Molecules

Molecule	IP(eV)	Molecule	IP(eV)
H	13.595	I2	9.28
C	11.264	HF	15.77
N	14.54	HCl	12.74
O	13.614	HBr	11.62
Si	8.149	HI	10.38
S	10.357	SO2	12.34
F	17.42	CO2	13.79
Cl	13.01	COS	11.18
Br	11.84	CS2	10.08
I	10.48	N2O	12.9
H_2	15.426	NO2	9.78
N_2	15.58	O3	12.8
O_2	12.075	H2O	12.59
CO	14.01	H2S	10.46
CN	15.13	H2Se	9.88
NO	9.25	H2Te	9.14
CH	11.1	HCN	3.91
OH	13.18	C2N2	13.8
F_2	15.7	NH3	10.15
Cl_2	11.48	CH3	9.84
Br_2	10.55	CH_4	12.98

Paraffins and Cycloparaffins

Molecule	IP(eV)
methane	12.98
ethane	11.65
propane	11.07
n-butane	10.63
I-butane	10.57
n-pentane	10.35
I-pentane	10.32
2,2-dimethylpropane	10.35
n-hexane	10.18
2-methlypentane	10.12
3-methlypentane	10.08
2,2-dimethlybutane	10.06
2,3-dimethlybutane	10.02
n-heptane	10.08
2,2,4-trimethylpentane	9.86
cyclopropane	10.06
cyclopentane	10.53
cyclohexane	9.88
methlycyclohexane	9.85

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Alkyl Halides

Molecule	IP(eV)
HCl	12.74
Cl_2	11.48
CH_4	12.98
methyl chloride	11.28
dichloroemethane	11.35
trichloromethane	11.42
tetrachloromethane	11.47
ethyl chloride	10.98
1,2-dichloroethane	11.12
1-chloropropane	10.82
2-chloropropane	10.78
1,2-dichloropropane	10.87
1,3-dichloropropane	10.85
1-chlorobutane	10.67
2-chlorobutane	10.65
1-chloro-2-methylpropane	10.66
2-chloro-2-methylpropane	10.61
HBr	11.62
Br_2	10.55
methyl bromide	10.53
dibromomethane	10.49
tribromomethane	10.51
CH_2BrCl	10.77
$CHBr_2Cl$	10.59
ethyl bromide	10.29
1,1-dibromoethane	10.19
1-bromo-2-chloroethane	10.63
1-bromopropane	10.18
2-bromopropane	10.075
1,3-dibromopropane	10.07
1-bromobutane	10.13
2-bromobutane	9.98
1-bromo-2-methylpropane	10.09

Alkyl Halides

Molecule	IP(eV)
methyl iodide	9.54
diiodomethane	9.34
ethyl iodide	9.33
1-iodopropane	9.26
2-iodopropane	9.17
1-iodobutane	9.21
2-iodobutane	9.09
1-iodo-2-methylpropane	9.18
2-iodo-2-methylpropane	9.02
1-iodopentane	9.19
F_2	15.7
HF	15.77
$CFCl_3$ (Freon 11)	11.77
CF_2Cl_2 (Freon 12)	12.31
CF_3Cl (Freon 13)	12.91
$CHClF_2$ (Freon 22)	12.45
$CFBR_3$	10.67
CF_2Br_2	11.07
CH_3CF_2Cl (Genetron 101)	11.98
$CFCl_2CF_2Cl$	11.99
CF_3CCl_3 (Freon 113)	11.78
$CFHBrCH_2Cr$	10.75
CF_2BrCH_2Br	10.83
CF_3CH_2I	10
n-C_3F_7I	10.36
n-$C_3F_7CH_2Cl$	11.84
n-$C_3F_7CH_2I$	9.96
2-bromo-2-methylpropane	9.89
1-bromopentane	10.1
HI	10.38
I_2	9.28

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aliphatic Alcohol, Ether, Thiol, and Sulfides

Molecule	IP(eV)
H_2O	12.59
methyl alcohol	10.85
ethyl alcohol	10.48
n-propyl alcohol	10.20
I-propyl alcohol	10.16
n-butyl alcohol	10.04
dimethyl ether	10.00
diethyl ether	9.53
n-propyl ether	9.27
I-propyl ether	9.20
H_2S	10.46
methanethiol	9.440
ethanethiol	9.285
1-propanethiol	9.195
1-butanethiol	9.14
dimethyl sulfide	8.685
ethyl methyl sulfide	8.55
diethyl sulfide	8.430
di-n-propyl sulfide	8.30

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aliphatic Aldehydes and Ketones

Molecule	IP(eV)
CO_2	13.79
formaldehyde	10.87
acetaldehyde	10.21
propionaldehyde	9.98
n-butyraldehyde	9.86
isobutyraldehyde	9.74
n-valeraldehyde	9.82
isovaleraldehyde	9.71
acrolein	10.10
crotonaldehyde	9.73
benzaldehyde	9.53
acetone	9.69
methyl ethyl ketone	9.53
methyl n-propyl ketone	9.39
methyl I-propyl ketone	9.32
diethyl ketone	9.32
methyl n-butyl ketone	9.34
methyl I-butyl ketone	9.30
3,3-dimethyl butanone	9.17
2-heptanone	9.33
cyclopentanone	9.26
cyclohexanone	9.14
2,3-butanedione	9.23
2,4-pentanedione	8.87

Aliphatic Acids and Esters

Molecule	IP(eV)
CO_2	13.79
formic acid	11.05
acetic acid	10.37
propionic acid	10.24
n-butyric acid	10.16
isobutyric acid	10.02
n-valeric acid	10.12
methyl formate	10.815
ethyl formate	10.61
n-propyl formate	10.54
n-butyl formate	10.50
isobutyl formate	10.46
methyl acetate	10.27
ethyl acetate	10.11
n-propyl acetate	10.04
isopropyl acetate	9.99
n-butyl acetate	10.01
isobutyl acetate	9.97
sec-butyl acetate	9.91
methyl propionate	10.15
ethyl propionate	10.00
methyl n-butyrate	10.07
methyl isobutyrate	9.98

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aliphatic Amines and Amides

Molecule	IP(eV)
NH_3	10.15
methyl amine	8.97
ethyl amine	8.86
n-propyl amine	8.78
I-propyl amine	8.72
n-butyl amine	8.71
I-butyl amine	8.70
s-butyl amine	8.70
t-butyl amine	8.64
dimethyl amine	8.24
diethyl amine	8.01
di-n-propyl amine	7.84
di-I-propyl amine	7.73
di-n-butyl amine	7.69
trimethyl amine	7.82
triethyl amine	7.50
tri-n-propyl amine	7.23
formamide	10.25
acetamide	9.77
N-methyl acetamide	8.90
N,N-dimethyl formamide	9.12
N,N-dimethyl acetamide	8.81
N,N-diethyl formamide	8.89
N,N-diethyl acetamide	8.60

Other Aliphatic Molecules with N Atom

Molecule	IP(eV)
nitromethane	11.08
nitroethane	10.88
1-nitropropane	10.81
2-nitropropane	10.71
HCN	13.91
acetonitrile	12.22
propionitrile	11.84
n-butyronitrile	11.67
acrylonitrile	10.91
3-butene-nitrile	10.39
ethyl nitrate	11.22
n-propyl nitrate	
methyl thiocyanate	10.065
ethyl thiocyanate	9.89
methyl isothiocyanate	9.25
ethyl isothiocyanate	9.14

Exhibit D-1.2 (cont'd)

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Olefins, Cyclo-ofefins, Acetylenes

Molecule	IP(eV)
ethylene	10.515
propylene	9.73
1-butene	9.58
2-methylpropene	9.23
trans-2-butene	9.13
cis-2-butene	9.13
1-pentene	9.50
2-methyl-1-butene	9.12
3-methyl-1-butene	9.51
3-methyl-2-butene	8.67
1-hexene	9.46
1,3-butadiene	9.07
isoprene	8.845
cyclopentene	9.01
cyclohexene	8.945
4-methylcyclohexene	8.91
4-cinylcylohexene	8.93
cyclo-octatetraene	7.99
acetylene	11.41
propyne	10.36
1-butyne	10.18

Some Derivatives of Olefins

Molecule	IP(eV)
vinyl chloride	9.995
cis-dichloroethylene	9.65
trans-dichloroethylene	9.66
trichloroethylene	9.45
tetrachloroethylene	9.32
vinyl bromide	9.80
1,2-dibromoethylene	9.45
tribromoethylene	9.27
3-chloropropene	10.04
2,3-dichloropropene	9.82
1-bromopropene	9.30
3-bromopropene	9.7
$CF_3CCl{=}CClCF_3$	10.36
n-$C_5F_{11}CF{=}CF_2$	10.48
acrolein	10.10
crotonaldehyde	9.73
mesityl oxide	9.08
vinyl methyl ether	8.93
allyl alcohol	9.67
vinyl acetate	9.19

Exhibit D-1.2 (cont'd)

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aromatic Compounds

Molecule	IP(eV)
benzene	9.245
toluene	8.82
ethyl benzene	8.76
n-propyl benzene	8.72
I-propyl benzene	8.69
n-butyl benzene	8.69
s-butyl benzene	8.68
t-butyl benzene	8.68
o-xylene	8.56
m-xylene	8.56
p-xylene	8.445
mesitylene	8.40
durene	8.025
styrene	8.47
alpha-methyl styrene	8.35
ethynylbenzene	8.815
napthalene	8.12
1-methylnapthalene	7.69
2-methylnapthalene	7.955
biphenyl	8.27
phenol	8.50
anisole	8.22
phenetole	8.13
benzaldehyde	9.53
acetophenone	9.27
benzenethiol	8.33
phenyl isocyanate	8.77

Aromatic Compounds

Molecule	IP(eV)
phenyl isothiocyanate	8.520
benzonitrile	9.705
nitrobenzene	9.92
aniline	7.70
fluoro-benzene	9.195
chloro-benzene	9.07
bromo-benzene	8.98
iodo-benzene	8.73
o-dichlorobenzene	9.07
m-dichlorobenzene	9.12
p-dichlorobenzene	8.94
1-chloro-2-fluorobenzene	9.155
1-chloro-3-fluorobenzene	9.21
1-chloro-4-fluorobenzene	8.99
o-fluorotoluene	8.915
m-fluorotoluene	8.915
p-fluorotoluene	8.785
o-chlorotoluene	8.83
m-chlorotoluene	8.83
p-chlorotoluene	8.70
o-bromotoluene	8.79
m-bromotoluene	8.81
p-bromotoluene	8.67
o-iodotoluene	8.62
m-iodotoluene	8.61
p-iodotoluene	8.50
benzotrifluoride	9.68
o-fluorophenol	8.66

Exhibit D-1.2 (cont'd)

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Heterocyclic Molecules

Molecule	IP(eV)
furan	8.89
2-methyl furan	8.39
2-furaldehyde	9.21
tetrahydrofuran	9.54
dihydropyran	8.34
tetrahydropyran	9.26
thiophene	8.860
2-chlorothiophene	8.68
2-bromothiophene	8.63
pyrrole	8.20
pyridine	9.32
2-picoline	9.02
3-picoline	9.04
4-picoline	9.04
2,3-lutidine	8.85
2,4-lutidine	8.85
2,6-lutidine	8.85

Miscellaneous Molecules

Molecule	IP(eV)
ethylene oxide	10.565
propylene oxide	10.22
p-dioxane	9.13
dimethoxymethane	10.00
diethoxymethane	9.70
1,1-dimethoxyethane	9.65
propiolactone	9.70
methyl disulfide	8.46
ethyl disulfide	8.27
diethyl sulfite	9.68
thiolacetic acid	10.00
acetyl chloride	11.02
acetyl bromide	10.55
cyclo-$C_6H_{11}CF_3$	10.46
$(n\text{-}C_3F_7)(CH_3)C{=}O$	10.58
trichlorovinylsilane	10.79
$(C_2F_5)_3N$	11.7
isoprene	9.08
phosgene	11.77

Notes:

Reference: HNU Systems, Inc., 1985

IP = Ionization Potential

Exhibit D-1.3

PID Calibration and Maintenance Log

Instrument Manufacturer:

Instrument Model Number:

Instrument Serial Number:

Lamp (Circle One) 9.5 eV 10.2 eV 11.7 eV

Date/Time	Initials	Battery Check	Standard Used/Expiration			Span Potentiometer Setting	Comments
			Source	Type	Concentration		

2. Attachment D-2 – pH Meter Calibration, Operations, and Maintenance Procedures

2.1 Introduction

The pH meter will be calibrated daily prior to use.

2.2 Materials

- 10.0, 7.0, 4.0 pH buffer solutions
- Thermometer
- Distilled water
- Disposable plastic beakers
- Calibration and maintenance log

2.3 Calibration Procedures

The pH meter will be calibrated as follows:

1. Switch on instrument.

2. Connect electrode to meter and remove protective cap.

3. Rinse electrode in distilled water.

4. Measure and record temperature of buffer solutions.

5. Immerse pH electrode in pH buffer 7.00, set the temperature control to that of the buffer 7.00 and allow sufficient time for the electrode to stabilize. Adjust the Standardize Control for the correct readout.

6. Rinse electrode with distilled water.

7. Immerse pH electrode in buffer 4.0, set the temperature control to that of the buffer 4.0 and allow sufficient time for the electrode to stabilize. Adjust the Slope Control for the correct readout.

8. a. Rinse the electrode with distilled water. The meter is calibrated and ready for use.
   b. (Optional step) If the pH is expected or could be between 7.0 to 10.0, then immerse the pH electrode in buffer 10.0, set temperature control, and allow sufficient time for the electrode to stabilize. Adjust the slope control for the correct read out.

9. Record calibration information on the Temperature/pH/DO/Conductivity Meter Calibration and Maintenance Log (Exhibit K-2).

2.4 Operation Procedures

1. Calibrate pH meter.

2. Rinse probe in distilled water.

3. Fill a disposable beaker with the water sample.

4. Insert probe into one sample beaker and obtain a reading. The meter will read between 0 and 14, in 0.01 increments.

5. Repeat Step 4.

6. Log results in field notebook and the average will be the actual result.

7. Rinse probe off in distilled water.

2.5 Maintenance Procedures

1. Replace batteries on a regular basis.

2. Store electrode in protective casing when not in use.

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

4. After use, the meter will be inspected and the inspection recorded in the field notebook.

5. A replacement meter will be available on-site or ready for overnight shipment, if necessary.

6. pH meter will be sent back to manufacturer for service, if needed.

7. Record maintenance information on the Temperature/pH/DO/Conductivity Meter Calibration and Maintenance Log (Exhibit K-2).

Exhibit D-2

Temperature/pH/DO/Conductivity Meter Calibration and Maintenance Log							
Instrument Manufacturer: Instrument Model Number: Instrument Serial Number:							
			Standard Used/Expiration			Battery	
Date/Time	Initials	Temp.	pH	Conduct	DO	Check	Comments

3. Attachment D-3 – Temperature/Conductivity Meter Calibration, Operation, and Maintenance Procedures

3.1 Introduction

The temperature/conductivity meter (HACH Model 44600 or equivalent) will be calibrated daily prior to use.

3.2 Materials

- Beaker capable of submerging the entire probe in a calibration liquid standard
- Calibration liquid standard (NaCl, 1,000 mg/L or equivalent)
- Fine end screw driver
- Disposable plastic beakers

3.3 Calibration Procedures

The conductivity meter will be calibrated as follows:

1. Be sure the probe is clean.
2. Soak the probe in distilled water for at least 30 minutes.
3. Remove the probe from the water and shake off distilled water.
4. Immerse the probe to or beyond the vent holes in a disposable beaker containing Sodium Chloride Standard Solution, 1,000 mg/L. Agitate vertically to remove trapped air.
5. Repeat Steps 3 and 4 at least once more.
6. Press the Power key and CND key. Verify that the LO BAT indicator does not appear.
7. Press the 2 milliSiemens per centimeter (mS/cm) range key.
8. Check the reading on the display. It should be 1.990 mS/cm. If adjustment is needed, use a small screwdriver to adjust the CAL control next to the display. Counterclockwise adjustment increases the reading.
9. Record calibration information on Temperature/pH/DO/ORP/Conductivity Meter Calibration and Maintenance Log (Exhibit K-2).

3.4 Operation Procedures - Temperature/Conductivity

1. Calibrate the conductivity meter.
2. Rinse probe in distilled water.

3. Fill a disposable beaker with water.

4. Turn meter to read temperature and record the temperature of the water twice.

5. Turn meter on to the 2 mS/cm scale.

6. Insert probe into sample beaker and obtain a reading. The meter will read between 0 and 20 mS/cm, in 0.001 increments.

7. Repeat Step 6.

8. Record results in the field notebook and the average will be the actual result.

9. Rinse probe off in distilled water.

3.5 Maintenance Procedures

1. Replace batteries on a regular basis.

2. Store electrode in protective casing when not in use.

3. Keep records of operation, maintenance, calibration, and of any problems and repair.

4. After use, the meter will be inspected and the inspection recorded in the log book.

5. A replacement meter will be available on-site or ready for overnight shipment, if necessary.

6. Conductivity meter will be sent back to manufacturer for service when needed.

4. Attachment D-4 – Dissolved Oxygen Meter Calibration, Operation, and Maintenance Procedures

4.1 Introduction

Dissolved oxygen (DO) will be measured using a YSI Model 50 Series or equivalent meter which will be calibrated prior to each field event.

4.2 Calibration Procedure

The dissolved oxygen meter will be calibrated as follows:

1. Prepare the probe with a thin Teflon® membrane stretched over the sensor.

2. Perform a battery check.

3. Set mode switch to operate and the operation switch to zero, and zero the instrument.

4. Take a temperature measurement and determine the calibration value from the provided table for the appropriate atmospheric pressure.

5. Select the desired range and adjust the instrument to an appropriate calibration value (determined in Step 4).

6. Place the probe in a water sample with a known dissolved oxygen level and read mg/L-dissolved oxygen.

7. Record temperature and dissolved oxygen calibration information on the Dissolved Oxygen Meter Calibration and Maintenance Log (Exhibit K-2).

4.3 Operation Procedure

1. Calibrate the dissolved oxygen meter.

2. Perform the battery check.

3. Fill a disposable beaker with water.

4. Set mode switch to operate and the operation switch to the desired range.

5. Place probe into water sample.

6. Take a temperature measurement and adjust temperature dial.

7. Switch to dissolved oxygen content measurement and allow reading to stabilize.

8. Record results in the field notebook.

9. Repeat procedure and record second reading. Average results and record.

10. Rinse the probe with distilled water.

4.4 Maintenance Procedures

1. Replace batteries on a regular basis.

2. Store electrode in protective casing when not in use.

3. Keep records of operation, maintenance, calibration, and any problems and repair.

4. A replacement dissolved oxygen meter will be ready for overnight shipment, if necessary.

5. Dissolved oxygen meter will be sent back to manufacturer for service when needed.

6. Record maintenance information on the Dissolved Oxygen Meter Calibration and Maintenance Log (Exhibit K-2).

5. Attachment D-5 – Water Level Probe Calibration Procedures

5.1 Introduction

The water level probe cable will be checked once to a standard to assess if the meter has been correctly calibrated by the manufacturer.

5.2 Materials

- Water level probe and cable
- Six-foot engineer's rule

5.3 Procedures

1. Each water level probe will be calibrated prior to using.
2. To calibrate, the lengths between each increment markers on the cable will be measured with a six-foot engineer's rule. The cable will be checked for the first 150 feet.
3. If markers are incorrect, the probe will be sent back to the manufacturer.
4. Record verification on form (Exhibit K-5).

Exhibit D-5

WATER LEVEL PROBE MAINTENANCE LOG							
Instrument Model Number: Instrument Serial Number:							
Date/Time	Initials	Battery Check	Sound Indicator Check	Light Indicator Check	Case	6-Foot Ruler	Comments

6. Attachment D-6 – Turbidity Meter Calibration, Operation and Maintenance Procedures

6.1 Introduction

The turbidity meter, a Cole-Parmer Model 8391-35 or equivalent, will be calibrated daily prior to use.

6.2 Materials

- Portable turbidity meter
- 0.5, 5.0, 40 Formazin standard solutions

6.3 Calibration Procedures

The turbidity meter will be calibrated as follows:

Zero Adjust

1. With the instrument turned off, check the meter needle position. If the needle does not read zero, adjust the mechanical zero screw.

2. Turn on the instrument and allow to warm up for 5 minutes.

3. Insert the black body into the sample well.

4. Turn the set standard control fully clockwise.

5. Place the NTU range switch to the x 0.01 position.

6. Adjust the circuit board mounted potentiometer to read zero on the meter (an access hole is marked on the right hand side of the instrument).

Note: An insulated, non-magnetized calibration screwdriver is required for both adjustments.

Calibrations of Secondary Standards

1. Make the Formazin standard or obtain a commercially available standard.

2. Set the NTU range switch to x 1 (0-100 NTU full scale).

3. Pour the 40 NTU Formazin or commercial standard into the chosen sample cuvette. Make certain that the sample cuvette is wiped clean of all dirt and finger prints. Insert the cuvette into the sample well and align properly. Cover with the light shield.

4. Use the SET STANDARD knob to adjust the meter needle to read exactly 40 NTU.

5. Remove the sample cuvette and insert the 40 NTU standard. Align the cuvette properly and cover with the light shield. Note the exact reading and record this value on the calibration and maintenance log (Exhibit K-6). This is the value that should now be used for the 40 NTU sealed standard.

6. Rinse the sample cuvette thoroughly and dry completely inside and out.

7. Fill the sample cuvette with the 5 NTU Formazin or commercial standard. Insert the sample cuvette into the test well. Align the cuvette properly and cover with the light shield.

8. Turn NTU RANGE knob to x 0.1 (0-10 NTU full scale). Use the SET STANDARD knob to adjust the meter needle to read exactly 50 (actually 5 NTU).

9. Remove the sample cuvette and insert the 5 NTU sealed standard. Align the cuvette properly and cover with the light shield. Note the exact reading and record this value on the calibration and maintenance log (Exhibit K-6). This is the value that should now be used for the 5 NTU sealed standard.

10. Rinse the sample cuvette thoroughly and dry completely inside and out.

11. Fill the sample cuvette with the 0.5 NTU Formazin or commercial standard. Insert the sample cuvette into the test well, align properly and cover with the light shield.

12. Turn NTU RANGE knob to x 0.01 (0-1 NTU full scale). Use the SET STANDARD knob to adjust the meter needle to read exactly 50 (actually 0.5 NTU).

13. Remove the sample cuvette and insert the 0.5 NTU sealed standard. Align the cuvette properly and cover with the light shield. Note the exact reading and record this value on the calibration and maintenance log (Exhibit K-6). This is the value that should be used for the NTU sealed standard.

14. Record calibration information on the Turbidity Calibration and Maintenance Log (Exhibit K-6).

6.4 Operation Procedures

1. Calibrate turbidity meter.

2. All samples should be measured using the same sample cuvette. Samples are read by inserting the sample cuvette, properly aligned with the key, into the test well. Cover with the light shield and take the reading off of the correct scale on the meter. Make certain to take the range factor (x 1, x 0.1, or x 0.01) into account when calculating the actual NTU value of the sample.

6.5 Maintenance Procedures

1. Replace batteries on a regular basis.

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

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

4. After use, the meter will be inspected and the inspection recorded in the field book.

5. A replacement meter will be available on-site or ready for overnight shipment, if necessary.

6. The turbidity meter will be sent back to the manufacturer for service when needed.

7. Record maintenance information on the Turbidity Calibration and Maintenance Log (Exhibit K-6).

Exhibit D-6

TURBIDITY CALIBRATION AND MAINTENANCE LOG						
Instrument Manufacturer: Instrument Model: Identification Number:						
Date/Time	Initials	Calibration/Standard		Standard Reading (NTU)		
		Type	Concentration	40	5	0.5
4						

ARCADIS

Appendix H

Quality Assurance Project Plan

Imagine the result

Appendix H

Quality Assurance Project Plan

Albany (Grand Street)
Non-Owned Former MGP Site
Albany, New York

June 2012

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Tables

Attachment

1. Introduction

1.1 Project Organization

Ongoing monitoring activities performed as part of the Site Management Plan (SMP) for the Albany Non-Owned former manufactured gas plant (MGP) Site (the “Site”) will require integration of personnel from the organizations identified below, collectively referred to as the “project team.” A detailed description of the responsibilities of each member of the project team is presented below.

1.1.1 Overall Project Management

On behalf of National Grid, ARCADIS of New York, Inc. (ARCADIS) will have overall responsibility for the ongoing monitoring activities performed as part of the SMP at the Site. As part of the ongoing monitoring activities, ARCADIS personnel will perform annual groundwater sampling activities. In addition, ARCADIS will be responsible for performing an annual site-wide inspection to monitor the condition of engineering controls and overall Site conditions. The rationale for the ongoing monitoring activities is provided in detail in the SMP. A site location map is included on Figure 1 in the SMP. The location of physical features at the site and the groundwater sampling locations are shown on Figures 2 and 16 in the SMP. Project direction and oversight will be provided by National Grid. A listing of the key project personnel is provided below.

Company/Organization	Title	Name	Phone Number
NYSDEC	Project Manager	R. Scott Deyette	(518) 402-9662
National Grid	Project Manager	James F. Morgan	(315) 428-3101
ARCADIS	Project Officer	James M. Nuss, P.E.	(315) 671-9230
	Project Manager	Michael C. Jones	(518) 671-9211
	Quality Assurance Manager	Dennis K. Capria	(315)-971-9299
Certified Analytical Laboratory (TBD)	Account Manager	TBD	--
	Project Manager	TBD	--
	Quality Assurance Manager	TBD	--

1.1.2 Task Managers

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

Company/Organization	Title	Name	Phone Number
ARCADIS	Field Task Manager	Allen Evans, P.E.	(530) 949-7144
	Analytical Task Manager	Allen Evans, P.E.	(530) 949-7144
	Health and Safety Manager	TBD	--
	Database Administrator	John Garrett	(315) 671-9642
	Data Validator	Dennis Capria	(315) 446-9120

1.2 Team Member Responsibilities

1.2.1 National Grid

Project Manager

Responsibilities and duties include:

- Overall direction of the ongoing monitoring/recovery activities
- Direction of ARCADIS
- Review of ARCADIS work products, including data, memoranda, letters, reports, and all other documents transmitted to the NYSDEC

1.2.2 ARCADIS

Project Officer

Responsibilities and duties include:

- Oversight during ARCADIS preparation of work products
- Provide ARCADIS approval for major project deliverables

Project Manager

Responsibilities and duties include:

- Management and coordination of all aspects of the project as defined in the SMP, with an emphasis on adhering to the objectives and schedule of the SMP
- Maintain communication with National Grid
- Review documents prepared by ARCADIS
- Assure corrective actions are taken for deficiencies cited during audits of site activities

Task Managers

The ongoing monitoring/recovery activities will be managed by Task Managers as set forth in Section 1.1.2. Responsibilities and duties of each Task Manager include:

- Manage relevant day-to-day activities
- Develop, establish, and maintain files on relevant site activities
- Review data reductions from the relevant site activities
- Perform final data review of field data reductions and reports on relevant site activities
- Assure corrective actions are taken for deficiencies cited during audits of relevant site activities
- Perform overall Quality Assurance/Quality Control (QA/QC) of the relevant portions of the work activities
- Review relevant field records and logs
- Instruct personnel working on relevant site activities
- Coordinate field and laboratory schedules pertaining to relevant site activities

- Request sample bottles from laboratory
- Review the field instrumentation, maintenance, and calibration to meet quality objectives
- Prepare reports pertaining to relevant site activities
- Maintain field and laboratory files of notebooks and logs, data reductions, and calculations, and transmit originals to the Project Manager

Field Personnel

Responsibilities and duties include:

- Perform field procedures associated with the sampling as set forth in the SMP
- Perform field analyses and collect QA samples
- Calibrate, operate, and maintain field equipment
- Reduce field data
- Maintain sample custody
- Prepare field records and logs

Quality Assurance Manager (QAM)

- Responsibilities and duties include
- Overall direction of the work activities
- Review laboratory data packages
- Oversee and interface with the analytical laboratory
- Coordinate field QA/QC activities with Task Managers, including audits of removal action activities, concentrating on field analytical measurements and practices to meet data quality objectives

- Review field reports

- Review audit reports

- Prepare interim QA/QC compliance reports

- Prepare a QA/QC report in accordance with United States Environmental Protection Agency (USEPA) guidelines, which includes an evaluation of field and laboratory data and data usability reports

1.2.3 Analytical Laboratories

- General responsibilities and duties of the analytical laboratories include
- Perform sample analyses and associated laboratory QA/QC procedures
- Supply sampling containers and shipping cartons
- Maintain laboratory custody of sample
- Strictly adhere to all protocols in the QAPP

Project Manager

Responsibilities and duties include:

- Serve as primary communication link between ARCADIS and laboratory technical staff

- Monitor workloads and ensure availability of resources

- Oversee preparation of analytical reports

- Supervise in-house chain-of-custody

Quality Assurance Manager

Responsibilities and duties include:

- Supervise the group that reviews and inspects all project-related laboratory activities

- Conduct audits of all laboratory activities

1.2.4 New York State Department of Conservation (NYSDEC)

Project Manager

Responsibilities and duties include:

- Provide NYSDEC review and approval of the SMP, supporting documents, and future deliverables
- Monitor progress of site activities
- Review and approval of the QAPP
- Review of the QA/QC portion of any submitted report
- Monitor progress of the work activities
- Ensure that all activities are performed in compliance with applicable federal and regional requirements
- Perform field and laboratory audits, if necessary

2. Project Background

2.1 Site Location and Description

The Albany (Grand Street) non-owned former MGP site is situated on three separate parcels in Albany, New York (shown on the site layout map presented as Figure 2 in the SMP). The largest parcel (identified as 127 Arch Street, 95 Trinity Place, and Trinity Substation on Figure 2 in the SMP) is located along the south side of Grand Street and is currently occupied by vacant industrial buildings and the National Grid Trinity Substation. The remaining parcels (identified as 17 Park Avenue, 30 Park Avenue, and 15 Warren Street on Figure 2 in the SMP) are located to the north and south of Park Avenue, approximately 500 feet west of the Grand Street parcel.

The Grand Street parcel is bordered by Grand Street to the west, residential buildings and a multistory apartment building (the Schuyler Apartments, which was previously a school) to the north, Trinity Place to the east, and Arch Street to the south. The National Grid Trinity Substation occupies the northern portion of the Grand Street parcel and vacant multistory industrial buildings (the former F. Jacobson & Sons Shirt Factory) occupy the southern portion of the parcel. One of the vacant buildings along Grand Street (95 Trinity Place as shown on Figure 2 in the SMP) was recently purchased by the Capital City Rescue Mission and current plans included developing the building into 44 temporary residence/itinerant apartments. The Trinity Substation is surrounded by an approximately 10-foot-high concrete wall. Access to the substation is restricted by locked gates located in the southwest (along Grand Street) and northeast (along Trinity Place) corners of the substation. Access to the southern portion of the parcel (the industrial buildings) is limited, with the exception of one driveway located along Arch Street which services a loading dock on the north side of the building.

2.2 Site History

The Albany (Grand Street) non-owned former MGP site is comprised of the former operations of the Albany Gas Light Company. Available historical information indicates that the original MGP operation was located on the Grand Street parcel of the site and that the parcels located north and south of Park Avenue were utilized for gas holders.

The available historical information indicates that the Albany Gas Light Company was the first MGP operation in the City of Albany with the gas works completed in 1845. In 1880, the Albany Gas Light Company and the People's Gas Light Company consolidated under the name of the People's Gas Company (which reportedly operated at the Grand Street site only). In 1886, the People's Gas Company was conveyed to the Municipal Gas Company of the City of Albany (Municipal Gas Company). By 1886, gas operations had resumed at the North Albany site and gas operations at the Grand Street site were phased out. In 1894, the Municipal Gas Company purchased the Albany Electric Illuminating Company (the first large-scale electrical utility for the City of Albany), which was located along Trinity Place (within the current National Grid Trinity Substation). In 1927, the Municipal Gas Company consolidated with the Eastern New York Utilities Corporation to form New York Power & Light Corporation. Niagara Mohawk Power Corporation was formed in 1950 by the consolidation of New York Power and Light Corporation with several additional New York State utility companies.

Based on available information, the original MGP operation was located almost entirely within the limits of the vacant multistory buildings located along Arch Street. The 1876 City Atlas indicates that the northern portion of the Grand Street parcel (the majority of the current substation) was the location of the Perry & Company Stove Works Foundry No. 3. Historical site features associated with the former MGP operations at the Grand Street parcel include a series of horizontal coal retorts that were located in the southern portion of the current substation or the northern portion of the former shirt factory property, the Shaw & McArdle Coal Yard which occupied the southwest corner of the current substation, a gas holder located at the corner of Arch and Grand Streets which was demolished between 1876 and 1892, and the brick and iron gas holder located in the northwest corner of the current substation that was constructed between 1876 and 1892. By 1892, the location of the original MGP operation (the southern portion of the Grand Street parcel) was occupied by carpentry shops, blacksmith shops and storage buildings. By 1909, the coal retorts had been removed and a "coal trestle" is shown at the location where the coal yard was formerly present. A small building located at the corner of Grand Street and Arch Street was occupied by a shirt factory and the former Albany Gas Light Company building at the corner of Arch Street and Trinity Place was used for storage by the Albany Electric Illuminating Company. By 1934, the shirt manufacturing operations expanded to occupy the entire block along Arch Street between Grand Street and Trinity place. Based on the Sanborn maps and substation drawings maintained by National Grid, the gas holder at the northwest corner of the current substation property was demolished between 1950 and 1971.

Historical MGP-related features at the parcel located south of Park Avenue include an iron gas holder, a small office and gas meter house, and two Albany Gas Light Company-owned buildings located along Warren Street and Phillip Street. The 1866 topographic atlas indicates that a small stream formerly crossed the southern portion of this parcel along Warren Street. The former MGP features on this parcel were constructed between 1866 and 1876. Historical use of the Albany Gas Light Company buildings located along Warren and Phillip Streets is not well documented. The Sanborn map indicates that by 1892 the building along Warren Street was vacant and that the building along Phillip Street was being used for storage. By 1909, the gas holder was noted to be “not in use” and the buildings along Warren Street and Phillip Street were listed as “J.C. Washerback – Wagon Storage and Sales Stable”. By 1934, the iron gas holder was gone, although the office and meter house remained and the portion of the parcel where the gas holder was located was listed as “McArdle & Casazza Garages and Warehouse”. The garage that currently occupies the former location of the gas holder was constructed between 1934 and 1950.

Historical MGP-related features at the parcel located north of Park Avenue consist of a gas holder that was constructed prior to 1866. Review of the available site maps indicate that the original gas holder on the parcel may have been demolished and replaced by a larger holder at some time between 1866 and 1876. By 1909, the gas holder was gone. The waste recycling building that currently occupies the former location of the gas holder was constructed between 1909 and 1934.

Current Site Status

As part of the multi-site VCO between National Grid and the NYSDEC, National Grid was listed as a responsible party for the Site and was required to investigate and remediate the site located in Albany, Albany County, New York.

After completion of the remedial work described in the SC Report/RAWP, some MGP-related residuals (including impacted subsurface soil and groundwater) remain in subsurface media at the Site. This Site Management Plan (SMP) was prepared to manage remaining MGP-related residuals at the site until a deed restriction (Appendix A) is no longer required in accordance with ECL Article 71, Title 36. All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

3. Project Description

3.1 Ongoing Monitoring Objectives

The monitoring and sampling of groundwater will be conducted to achieve the following objectives:

- Evaluate the groundwater quality of the overburden fill.
- Evaluate the groundwater flow pattern.
- Evaluate the groundwater concentrations of Constituents of Concern (COCs).
- Confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

3.2 Approach

The ongoing monitoring activities will consist of the following tasks to address the above-referenced objectives:

- Annual Groundwater Sampling
- Annual Site-Wide Inspection

A description of the activities to be completed under each work task referenced above is presented in the SMP.

4. Quality Objectives and Criteria for Measurement Data

The data quality objectives (DQO) process, as described in the USEPA QA/G-4 QAPP instructions document, is intended to provide a "logical framework" for planning field sampling activities. The following sections addressed, in turn, each of the seven sequential steps in the USEPA QA/G-4 DQO process.

Step 1: Problem Statement

National Grid completed remedial actions based on the results of site characterization and the current and anticipated future use(s) of the Site. After completion of the remedial actions, MGP-related residuals (including impacted subsurface soil and groundwater) remain in subsurface media at the site. The ongoing monitoring program is intended to manage and monitor engineering controls and institutional controls that have been implemented as part of the SMP at the Site.

Step 2: Decision Identification

The initial use of the data is to monitor the distribution and concentration of Site constituents, and there is no decision point for this descriptive application. The decision in this case is to determine whether or not unacceptable risk is present at the Site and whether the current SMP needs to be revised based on the distribution and concentrations of Site constituents present.

Step 3: Identifying Decision Inputs

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

Step 4: Defining the Study Boundaries

The Site is bordered by Grand Street to the west, residential buildings and a multistory apartment building (the Schuyler Apartments, which was previously a school) to the north, Trinity Place to the east, and Arch Street to the south.

Step 5: Developing a Decision Rule

The decision on whether data can be used to support the project objectives will be based on the validation results. Following validation, the data will be flagged, as appropriate, and any use restrictions noted. A reasonable decision rule would be that 90% of the data points not be rejected and deemed unusable.

Step 6: Limits on Decision Errors

Specifications for this step call for: 1) giving forethought to corrective actions to improve data usability; and 2) understanding the representative nature of the sampling design. This QAPP has been designed to meet both specifications for this step. The sampling and analysis program has been developed based on a review of previous site data and knowledge of present Site conditions. Corrective actions are described elsewhere in the document and in the appended contractor documents. The representative nature of the sampling design has been assured by discussions among professionals familiar with the Site and the appropriate government agencies.

Step 7: Design Optimization

The overall quality assurance objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which will provide the means to manage and monitor engineering controls and institutional controls that have been implemented as part of the SMP at the Site, and be consistent with National Contingency Plan (NCP) requirements. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

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

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

4.1 Data Categories

A wide range of data quality is achieved through the use of various analytical methods. There are three analytical categories that address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These categories include:

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

- Screening Data with Definitive Confirmation: Screening data provide rapid identification and quantitation; however, because screening generally involves the use of less precise methods of analysis with less rigorous sample preparation, the quantitation may be relatively imprecise. Generally, at least 10% of the data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. This objective can also be used to verify less rigorous laboratory-based methods. This objective of data quality is available for data collection activities that require qualitative and/or quantitative verification of a select portion of sample findings.

- Definitive Data: Definitive data are generated using rigorous analytical methods, such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For data to be definitive, either analytical or total measurement error must be determined. Definitive data are used for site characterization, environmental monitoring, confirmation of field data, and to support engineering studies or risk assessments. Definitive data are used to confirm lower level data, risk assessment, and to obtain highly documented data.

It is anticipated that both the screening and definitive data categories will be used during the sampling. Field parameters (e.g., turbidity, conductivity, temperature, dissolved oxygen, and pH) that will be obtained during groundwater sampling will be determined using screening techniques. All remaining parameters will be determined using definitive techniques.

The following levels of data reporting have been defined as potentially applicable to the ongoing monitoring/recovery activities:

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

Level 2 - Limited Reporting: Limited reporting is used when some additional QC information is required. The documentation includes sample analytical results as well as summarized QC sample results.

Level 3 - Expanded Reporting: Modified reporting is used for analyses that are performed following standard USEPA-approved methods and QA/QC protocols and that, based on the intended data use, require some supporting documentation but not, however, full “Contract Laboratory Program (CLP)-type” reporting.

Level 4 - Full Reporting: Full “CLP-type” reporting is used for those analyses that, based on the intended data use, require full documentation.

The reporting levels for the individual sampling efforts described herein are presented in the following sections.

4.2 Annual Groundwater Sampling

Data Uses

The annual groundwater sampling activities are designed to generate hydrogeologic and water quality data to support the following evaluations:

- Evaluate the groundwater quality of the overburden fill.
- Evaluate the groundwater flow pattern.
- Evaluate the groundwater concentrations of Constituents of Concern (COCs).

- Confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

<u>Data Types</u>

As set forth in the SMP, physical and chemical data for groundwater are required to meet the DQOs of the annual groundwater sampling activities, as follows:

- Physical data for groundwater will consist of water level information from the existing monitoring wells at the Site. Groundwater flow direction and velocity will be determined using the water level data and geometric mean hydraulic conductivity for the soil at site. In addition, field parameters consisting of pH, conductivity, dissolved oxygen, temperature, and turbidity will be measured

- Chemical data for groundwater samples will consist of TCL VOCs

The SMP provides the rationale for the physical and chemical parameters selected for analysis for the annual groundwater sampling activities.

<u>Data Quality</u>

Laboratory analysis of the groundwater samples collected as part of the annual groundwater sampling activities will be conducted using Method 8260 for laboratory analysis for TCL VOCs following USEPA SW-846 Methods as referenced in the NYSDEC 2005 ASP.

The analytical results will be reported using NYSDEC ASP Category B deliverables (i.e., Reporting Level 4). Field measurement of pH, conductivity, dissolved oxygen, temperature, and turbidity will be performed in accordance with the equipment manufacturer's procedures, as outlined in the appendices to this QAPP (Analytical Level 1).

The specific VOCs to be analyzed for groundwater samples collected as part of the annual groundwater sampling activities include the VOCs on the compound lists established for the above-referenced methods by the USEPA (and selected VOCs on the supplemental compound list established for Method 8260 by the USEPA). The specific VOCs to be analyzed for groundwater samples collected as part of the annual groundwater sampling activities are presented in Table 1.

Data Quantity

The annual groundwater sampling activities will consist of collecting groundwater samples from eight monitoring well locations including MW-5, MW-6, MW-7, MW-8A, MW-9, MW-10 and MW-14. Measurements of pH, conductivity, dissolved oxygen, temperature, and turbidity will be obtained for each groundwater sample collected for the annual groundwater sampling activities. The type and quantity of QA/QC samples to be submitted for laboratory analysis during the annual groundwater sampling activities are presented in Table 2.

Sampling and Analytical Methods

The groundwater level measurement procedures, water quality measurement procedures, and groundwater sampling procedures are provided in the FSP. The laboratory analytical methods for groundwater samples are presented in Table 3.

Measurement Performance Criteria

Precision and accuracy QC limits for chemical constituents, which are used during data validation to assess analytical performance, are presented in Table 4. When possible, these limits reflect the laboratory's control limits, although as noted on the table, published guidance limits are identified in some situations. Published method accuracy limits are used to provide the required analytical control.

Data representativeness is addressed by the sample quantities and locations identified in the SMP. Data comparability is intended to be achieved through the use of standard USEPA-approved and NYSDEC ASP-approved methods.

5. Special Training Requirements/Certification

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

6. Documentation and Records

6.1 General

Groundwater samples will be collected as described in the SMP. Detailed descriptions of the sample designation system, documentation and reporting requirements are presented below.

6.2 Sample Designation System

6.2.1 Sample Codes

A sample designation code and the sample date will provide each sample with a unique "name". This alphanumeric system will apply to all groundwater samples which are collected and submitted for laboratory analysis. The sample designation code system includes a letter prefix describing the sample matrix and a number indicating the sample location. Letter prefixes that will be used for the sample designation code system are as follows:

- Groundwater – "MW"

The sample location number will be assigned by the field sampling personnel prior to each sampling event. Rinse blank, trip blank, and blind duplicate samples will be designated as follows:

- Rinse Blank – "RB"
- Trip Blank – "TB"
- Blind Duplicate – "DUP"

Where necessary, the code system will be supplemented to accommodate additional sample identification information.

Multiple rinse blank, trip blank, and blind duplicate samples will be distinguished by adding a numeric suffix which is preceded by the letter code and a hyphen (i.e., RB-1, RB-2, etc.). Additional sample volumes collected for matrix spike ("MS") and matrix spike duplicate ("MSD") analysis will be noted on the chain-of-custody forms, and the associated additional sample containers will be labeled, as described above, with the appropriate suffix ("MS" or "MSD").

6.3 Field Documentation

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

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

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

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

- Sample Chain-of-Custody - Chain-of-custody (COC) forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. COC forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by ARCADIS' field personnel responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the COC form will be signed and dated by the appropriate personnel to document the sample transfer. The original COC form will accompany the samples to the laboratory, and copies will be forwarded to the project files.

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

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

6.4 Laboratory Documentation Files

6.4.1 Laboratory Project Files

The laboratory will establish a file for pertinent data. The file will include COC forms, raw data, chromatograms, correspondence, and faxed information. The laboratory will retain project files and data packages for not less than a period of 5 years.

6.4.2 Laboratory Logbooks

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

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

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

Laboratory notebooks will be periodically reviewed by the laboratory group leaders for accuracy, completeness, and compliance to this QAPP. All entries and calculations will be verified by the laboratory group leader. If all entries on the pages are correct, then the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

6.4.3 Computer Tape and Hard Copy Storage

All electronic files and deliverables will be retained for not less than five years; hard copy data packages (or electronic copies) will also be retained for not less than five years.

6.5 Data Reporting Requirements

6.5.1 Field Data Reporting

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

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

6.5.2 Laboratory Data Reporting

The laboratory is responsible for reporting the data in tabular format. Data will be tabulated by method and sample with reference to the sample by both field and laboratory identifications. The data tables will provide a cross-reference between each sample and the appropriate QC data package.

The laboratory will prepare full NYSDEC ASP Category B data packages and case narratives for each sample delivery group for the laboratory analyses for VOC constituents. Reports will include all raw data required to recalculate any result, including sample and standard printouts, chromatograms, and quantitation reports. In addition, sample preparation records including extraction sheets, digestion sheets, percent solids, and logbook pages will also be provided in the data package.

6.6 Project File

Project documentation will be placed in project files according to ARCADIS requirements identified in the corporate quality procedure (QP 1.02) for document management. Project files typically consist of the following components:

1. Agreements/Proposals (filed chronologically)
2. Change Orders/Purchase Orders (filed chronologically)
3. Invoices (filed chronologically)
4. Project Management (filed by topic)

5. Correspondence (filed chronologically)
6. Notes and Data (filed by topic)
7. Public Relations Information (filed by topic)
8. Regulatory Documents (filed chronologically)
9. Marketing Documents (filed chronologically)
10. Final Reports/Presentations (filed chronologically)
11. Draft Reports/Presentations (filed chronologically)
12. Documents Prepared by Others (filed chronologically)

Final reports (including QAPPs and QA reports) are filed in folder #10 – Final Reports/Presentations. Analytical laboratory documentation (when received) and field data are filed in folder #6 – Notes and Data. Filed materials may be removed and signed out by authorized personnel on a temporary basis only.

7. Sample Process Design

The sampling process for the annual groundwater sampling activities has been designed to satisfy the requirements of the VCO for the site. The goal of the sampling process is to collect sufficient data to monitor the distribution and concentration of Site constituents in subsurface media at the Site and to confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

8. Sample Method Requirements

As part of the field sampling activities, several standard field procedures will be utilized. This section of the QAPP presents the sampling methodologies that will be used for the field sampling. Sample handling, packing, and shipping are discussed in Section 9. Equipment maintenance requirements and instrument calibration and frequency are discussed in Sections 12 and 13, respectively. Sample quantities and analytical constituents and parameters for the following sections are summarized in Table 1, 2, and 3. The required sample containers, volumes, preservation, and holding times are summarized in Table 5.

8.1 Sampling Equipment and Procedures

8.1.1 Groundwater Level Measurement

Groundwater-level measurements will be measured using an electric water level meter and an electronic oil/water interface probe using the procedures described in the FSP.

8.1.2 Groundwater Sampling

Groundwater samples will be collected using bottom-loading polyethylene bailers. The groundwater sampling procedures are presented in the FSP.

9. Sample Handling and Custody Requirements

9.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for the annual groundwater sampling samples are shown in Table 5.

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

9.2 Field Custody Procedures

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

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

9.2.1 Field Logbooks

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

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

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

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

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

Samples will be collected following the sampling procedures documented in Section 8. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

9.2.2 Sample Labeling

The following information is required on each sample label:

- Project
- Date collected
- Time collected
- Location
- Sampler
- Analysis to be performed
- Preservative
- Sample number

9.2.3 Field Chain-of-Custody Forms

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

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

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

9.3 Management of Investigation-Derived Materials and Wastes

Management of sample-derived materials and wastes will be performed consistent with the USEPA guidance Guide to Management of Investigation – Derived Wastes, 9345.3-03FS, dated January 1992. Disposable equipment (including personal protective equipment) and debris will be containerized and appropriately labeled during the sampling events, and will be disposed of accordingly. All purged groundwater and water generated during equipment decontamination will be containerized and staged onsite in a 55-gallon drum or polyethylene storage tank, and will be disposed of appropriately based on analytical results.

9.4 Packing, Handling and Shipping Requirements

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

Samples will be packaged for shipment as outlined below:

- Ensure that sample containers have sample labels securely affixed to the container with clear packing tape
- Check the caps on the sample containers to ensure that they are properly sealed
- Wrap the sample container cap with clear packing tape to prevent it from becoming loose
- Complete the COC form with the required sampling information and ensure that the recorded information matches the sample labels. NOTE: If the designated sampler relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the COC prior to this transfer. The appropriate personnel will sign and date the COC form to document the sample custody transfer
- Using duct tape, secure the outside drain plug at the bottom of the cooler
- Wrap sample containers in bubble wrap or other cushioning material
- Place 1 to 2 inches of cushioning material at the bottom of the cooler
- Place the sealed sample containers into the cooler
- Place ice in plastic bags and seal. Place loosely in the cooler
- Fill the remaining space in the cooler with cushioning material
- Place COC forms in a plastic bag and seal. Tape the forms to the inside of the cooler lid
- Close the lid of the cooler, lock, and secure with duct tape

- Wrap strapping tape around both ends of the cooler at least twice
- Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels, and arrows indicating “this side up.” Cover the labels with clear plastic tape. Place a signed custody seal over the cooler lid.

Samples will be packaged by the field personnel and transported as low-concentration environmental samples. The samples will be hand-delivered or delivered by an express carrier within 48 hours of the time of collection. Shipments will be accompanied by the COC form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records. If the samples are sent by common carrier, a bill of lading will be used. Receipts or bills of lading will be retained as part of the permanent project documentation. Commercial carriers are not required to sign off on the COC form as long as the forms are sealed inside the sample cooler and the custody seals remain intact.

Sample custody seals and packing materials for filled sample containers will be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to eliminate the possibility of container breakage.

9.5 Laboratory Custody Procedures

9.5.1 General

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field COC form will accompany all samples requiring laboratory analysis. The laboratory will use COC guidelines described in the USEPA guidance documents. Samples will be kept secured in the laboratory until all stages of analysis are complete. All laboratory personnel having samples in their custody will be responsible for documenting and maintaining sample integrity.

9.5.2 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the cooler seal, open the cooler, and compare the contents against the field COC. If a sample container is missing, a sample container is received broken, the sample is in an inappropriate container, or has not been preserved by appropriate means, ARCADIS will be notified. The laboratory sample custodian will be responsible for logging the samples in, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis. The project name, field sample code, date sampled, date received, analysis required, storage location and date, and action for final disposition will be recorded in the laboratory tracking system. Relevant custody documentation will be placed in the project file.

9.5.3 Sample Analysis

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

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

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

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

9.5.4 Sample Storage Following Analysis

Samples will be maintained by the laboratory for one month after the final report is delivered to ARCADIS. After this period, the laboratory is responsible for the disposal of the samples. Unused portions of the samples, sample extracts and associated wastes will be disposed of by the laboratory in accordance with applicable rules and regulations as specified in their SOP for waste disposal.

10. Analytical Method Requirements

10.1 Field Parameters and Methods

The methods listed below include the range of analyses expected to be performed.

10.1.1 Groundwater

Groundwater-level measurements will be made with the use of an electronic water-level or interface probe. Field measurement of the water-quality parameters pH, temperature, specific conductance, dissolved oxygen, and turbidity will be conducted using a multi-parameter field meter (e.g. Horiba U-22®, or similar). Field instruments will be calibrated daily following the manufacturers recommended procedures.

10.2 Laboratory Parameters and Methods

The methods listed below include the range of analyses expected to be performed.

10.2.1 Groundwater Sampling

Groundwater samples will be analyzed for:

TCL VOCs	NYSDEC ASP (USEPA SW-846 Method 8260)

10.2.2 Waste Characterization Sampling

Waste characterization samples will be analyzed for:

TCLP VOCs	NYSDEC ASP (USEPA SW-846 Method 1311/8260)
TCLP SVOCS	NYSDEC ASP (USEPA SW-846 Method 1311/8270)
TCLP Metals	NYSDEC ASP (USEPA SW-846 Method 1311/6010/7000)
Corrosivity	NYSDEC ASP (SW-846 Chapter 7)
Ignitability	NYSDEC ASP (SW-846 Chapter 7)
Reactivity	NYSDEC ASP (SW-846 Chapter 7)

11. Quality Control Procedures

11.1 Quality Assurance Indicators

The overall quality assurance objective for this QAPP is to develop and implement procedures for sampling, COC, laboratory analysis, instrument calibration, data reduction and reporting, internal quality control, audits, preventive maintenance, and corrective action, such that valid data will be generated. These procedures are presented or referenced in the following sections of the QAPP. Specific QC checks are discussed in Section 11.2.

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

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

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

11.1.1 Representativeness

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

11.1.2 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between phases of the actions (if additional phases are required) will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP and through the use of established QA/QC procedures, and the utilization of appropriately trained personnel.

11.1.3 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results, as discussed in Section 11.6.

11.1.4 Precision

Precision is a measure of the reproductability of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the action. To maximize precision, sampling and analytical procedures will be followed. All work for the site actions will adhere to established protocols presented in the QAPP. Checks for analytical precision will include the analysis of matrix spike, matrix spike duplicates, laboratory duplicates and field duplicates. Checks for field measurement precision will include obtaining duplicate field measurements. Further discussion of precision QC checks is provided in Section 11.4.

11.1.5 Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, matrix spikes, blank spikes, and surrogate standards will be used to assess the accuracy of the analytical data.

11.2 Field Quality Control Checks

11.2.1 Field Measurements

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

11.2.2 Sample Containers

Certified-clean sample containers (I-Chem 300 Series or equivalent) will be supplied by the laboratory. Certificates of analysis will be filed in the project file.

11.2.3 Field Duplicates

Field duplicates will be collected from the different site materials to verify the reproducibility of the sampling methods. Field duplicates will be prepared by placing well homogenized aliquots from the same sample location into individual sample containers, which are submitted blind to the laboratory. In general, field duplicates will be analyzed at a 5 percent frequency (every 20 samples) for the chemical constituents. Table 2 provides an estimated number of field duplicates to be prepared for each applicable parameter and matrix.

11.2.4 Rinse Blanks

Rinse blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Rinse blanks will be prepared and submitted for analysis at a ratio of one per 20 field samples, or once per week of sampling, whichever is most frequent. Rinse blanks will be prepared by filling sample containers with analyte-free water (supplied by the laboratory) which has been routed through a cleaned sampling device. When dedicated sampling devices are used or sample containers are used to collect the samples, rinse blanks will not be necessary. Table 2 provides an estimated number of rinse blanks for environmental media samples to be collected during the annual groundwater sampling activities.

11.2.5 Trip Blanks

Trip blanks will be used to assess whether site samples have been exposed to non-site-related volatile organic constituents during sample storage and transport. Trip blanks will be analyzed at a frequency of once per day, for each cooler containing groundwater samples to be analyzed for volatile organic constituents. A trip blank will consist of a container filled with analyte-free water (supplied by the laboratory) which remains unopened with field samples throughout the sampling event. Trip blanks will only be analyzed for volatile organic constituents. The estimated number of trip blanks to be collected for each matrix and parameter during the annual groundwater sampling activities is presented in Table 2.

11.2.6 Zero Span Gasses

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

11.3 Analytical Laboratory Quality Control Checks

Internal laboratory quality control checks will be used to monitor data integrity. These checks will include method blanks, matrix spikes (and matrix spike duplicates), spike blanks, internal standards, surrogate samples, calibration standards, and reference standards. Project QC limits for duplicates and matrix spikes are identified in Table 4. Laboratory control charts will be used to determine long-term instrument trends.

11.3.1 Method Blanks

Sources of contamination in the analytical process, whether specific analyses or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank is initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the method blank would assist in accounting for any potential contamination attributable to glassware, reagents, instrumentation, or other sources which could affect sample analysis. One method blank will be analyzed with each analytical series associated with no more than 20 samples.

11.3.2 Matrix Spikes/Matrix Spike Duplicates

Matrix spikes and matrix spike duplicates will be used to measure the accuracy of analyte recovery from the sample matrices. Matrix spikes and matrix spike duplicates will be site-specific. Matrix spike duplicate pairs will be analyzed at a 5 percent frequency (every 20 samples or once every week, whichever comes first).

When matrix spike recoveries are outside QC limits, associated control sample and surrogate spike recoveries will be evaluated, as applicable, to attempt to verify the reason for the deviation and determine the effect on the reported sample results.

Table 2 presents an estimated number of matrix spike and matrix spike duplicate analyses for each applicable parameter.

11.3.3 Surrogate Spikes

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

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

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

11.3.4 Laboratory Duplicates

Laboratory duplicates will be analyzed to assess laboratory precision. Laboratory duplicates are defined as a separate aliquot of an individual sample that is analyzed as a separate sample. Table 2 presents an estimated number of laboratory duplicates for each applicable parameter.

11.3.5 Calibration Standards

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

In general, calibration check standards will be analyzed after every 12 hours, or more frequently as specified in the applicable analytical method. If results of the calibration check standard exceed specified tolerances, then samples analyzed since the last acceptable calibration check standard will be reanalyzed.

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

11.3.6 Reference Standards/Control Samples

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

11.4 Data Precision Assessment Procedures

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

Laboratory data precision will be monitored through the use of matrix spike/matrix spike duplicate and laboratory duplicate sample analyses.

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

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

Where:
A = Analytical result from one of two duplicate measurements
B = Analytical result from the second measurement

Precision objectives for duplicate analyses are identified in Table 4.

11.5 Data Accuracy Assessment Procedures

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

Laboratory accuracy will be assessed via the use of matrix spikes, surrogate spikes and reference standards. Where available and appropriate, QA performance standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated in terms of percent recovery as follows:

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

Where:

A = Value measured in spiked sample or standard
X = Value measured in parent sample
B = True value of amount added to sample or true value of standard

This formula is derived under the assumption of constant accuracy between the original and spiked measurements. Accuracy objectives for matrix spike recoveries are identified in Table 4.

11.6 Data Completeness Assessment Procedures

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

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

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

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

12.1 General

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

12.2 Field Instruments and Equipment

Prior to any field sampling, each piece of field equipment will be inspected to assure it is operational. It is anticipated that all field instruments used in the annual groundwater sampling activities will be rented from an equipment vendor. It is the responsibility of the appropriate Task Manager or field personnel to determine that the rental equipment has been properly maintained and is in good working order. If the equipment is not operational, it will be returned to the equipment for service or replacement prior to its use. If instrument servicing is required, it is the responsibility of the appropriate Field Task Manager or field personnel to follow the maintenance schedule and arrange for prompt service. A summary of preventive maintenance requirements for field instruments is provided in Table 6. Details regarding field equipment maintenance, operation, and calibration are provided in the FSP. All meters which require charging or batteries will be fully charged and have fresh batteries.

12.3 Laboratory Instruments and Equipment

12.3.1 General

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

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

12.3.2 Instrument Maintenance

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

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

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

13. Instrument Calibration and Frequency

13.1 Field Instruments and Equipment

Field personnel are responsible for ensuring that a record of equipment calibration and maintenance log is maintained in the field book. Calibration record sheets provided by equipment vendors shall be retained for project file. Where applicable, the following information will be recorded:

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

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated at the intervals specified by the manufacturer or more frequently, and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. A summary of minimum frequencies for calibration of select field instruments and equipment is presented in Table 7. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service. Equipment found to be out of tolerance during the period of use shall be removed from the field and measuring and testing activities performed using the equipment shall be addressed via the corrective action system described in Section 17.4 of this QAPP.

13.2 Laboratory Instruments and Equipment

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

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

14. Inspection/Acceptance Requirements for Supplies and Consumables

All laboratory reagents will be tested prior to use with site samples. All standards will be verified against a second source standard. The laboratory will follow a “first in, first out” procedure for the storage and use of all consumables to minimize the risk of contamination and degradation.

15. Data Acquisition Requirements for Non-Direct Measurements

Prior to their use, historical data sets will be reviewed according to the procedures identified in subsequent sections of this QAPP to determine the appropriate uses of such data. The extent to which these data can be validated will be determined by the analytical level and QC data available. The evaluation of historic data requires the following:

- Identification of analytical levels
- Evaluation of QC data, when available
- Development of conclusions regarding the acceptability of the data for intended uses

Acceptability of historic data for intended uses will be determined by application of these procedures and professional judgment. If the historic data quality cannot be determined, its use will be limited to general guidance in the decision-making process. Historic data that have been generated consistent with NCP requirements will be used in decision-making for the site.

16. Data Management

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

The data management program established for the project includes field documentation and sample QA/QC procedures, methods for tracking and managing the data, and a system for filing all site-related information. More specifically, data management procedures will be employed to efficiently process the information collected such that the data are readily accessible and accurate. These procedures are described in detail in the following section.

The data management plan has five elements: 1) sample designation system, 2) field activities, 3) sample tracking and management, and 4) data management system.

16.1 Sample Designation System

A concise and easily understandable sample designation system is an important part of the project sampling activities. It provides a unique sample number that will facilitate both sample tracking and easy re-sampling of select locations to evaluate data gaps, if necessary. The sample designation system to be employed during the sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events or conditions. A combination of letters and numbers will be used to yield a unique sample number for each field sampled collected, as outlined in Section 6.2.1.

16.2 Field Activities

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

16.2.1 Field Documentation

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

- Field logs
- Chain-of-custody forms

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

Field Logs

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

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

Chain-of-Custody Forms

COC forms are used as a means of documenting and tracking sample possession from time of collection to the time of disposal. A COC form will accompany each field sample collected, and one copy of the form will be filed in the field office. All field personnel will be briefed on the proper use of the COC procedure.

16.2.2 Data Security

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

16.3 Sample Management and Tracking

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

Sample tracking will begin with the completion of COC forms as summarized in Section 9.2.3. The completed COC forms associated with samples collected will be faxed to the QAM. Copies of all completed COC forms will be maintained in the field office. The laboratory shall verify receipt of the samples electronically (via email) on the following day.

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

16.4 Data Management System

In addition to the sample tracking system, a data management system will be implemented. The central focus of the data management system will be the development of a personal computer-based project database. The project database, to be maintained by the Database Administrator, will combine pertinent geographical, field, and analytical data. Information that will be used to populate the database will be derived from three primary sources: surveying of sampling locations, field observations, and analytical results. Each of these sources is discussed in the following sections.

16.4.1 Computer Hardware

The database will be constructed on Pentium®-based personal computer work stations connected through a Novell network server. The Novell network will provide access to various hardware peripherals, such as laser printers, backup storage devices, image scanners, modems, etc. Computer hardware will be upgraded to industrial and corporate standards, as necessary, in the future.

16.4.2 Computer Software

The database will be written in Microsoft Access, running in a Windows operating system. Custom applets, such as diskette importing programs, will be written in either Microsoft VBA or Microsoft Visual Basic. Geographic Information System (GIS) applications will be developed in ESRI ArcGIS, with additional customization performed with Visual Basic. Tables and other database reports will be generated through Access in conjunction with Microsoft Excel, Microsoft Word, and/or Seagate Crystal Reports. These software products will be upgraded to current industrial standards, as necessary.

16.4.3 Field Observations

An important part of the information that will ultimately reside in the data management system for use during the project will originate in the observations that are recorded in the field. Refer to Section 16.2.1 for details on how field observations are to be recorded.

16.4.4 Analytical Results

Analytical results will be provided by the laboratory in both a digital and a hard copy format. The data packages will be examined to ensure that the correct analyses were performed for each sample submitted and that all of the analyses requested on the COC form were performed. If discrepancies are noted, the QAM will be notified and will promptly follow up with the laboratory to resolve any issues.

Each data package will be validated in accordance with the procedures presented in Section 20.1. Any data that does not meet the specified standards will be flagged pending resolution of the issue. The flag will not be removed from the data until the issue associated with the sample results is resolved. Although flags may remain for certain data, the use of that data may not necessarily be restricted.

Following completion of the data validation, the digital files will be used to populate the appropriate database tables. An example of the format of electronic data deliverable (EDD) format is included in Table 9. This format specifies one data record for each constituent for each sample analyzed. Specific fields include:

- Sample identification number
- Date sampled
- Date analyzed
- Parameter name
- Analytical result
- Units
- Detection limit
- Qualifier(s)

The individual EDDs, supplied by the laboratory in either an ASCII comma separated value (CSV) format or in a Microsoft Excel worksheet, will be loaded into the appropriate database table via a custom-designed user interface Visual Basic program. Any analytical data that cannot be provided by the laboratory in electronic format will be entered manually. After entry into the database, the EDD data will be compared to the field information previously entered into the database to confirm that all requested analytical data have been received.

16.4.5 Data Analysis and Reporting

The database management system will have several functions to facilitate the review and analysis of the annual groundwater sampling data. Routines have been developed to permit the user to scan analytical data from a given site for a given media. Several output functions are also available which can be modified, as necessary, for use in the data management system.

A valuable function of the data management system will be the generation of tables of analytical results from the project databases. The capability of the data management system to directly produce tables reduces the redundant manual entry of analytical results during report preparation and precludes transcription errors that may occur otherwise. This data management system function creates a digital file of analytical results and qualifiers for a given media. The file can then processed into a table of rows and columns which can be transferred to word processing software (e.g., Microsoft Word) for final formatting and addition of titles and notes.

Another function of the data management system will be to create digital files of analytical results and qualifiers suitable for transfer to mapping/presentation software. A function has been created by ARCADIS that creates a digital file consisting of sample location number, state plane coordinates, sampling date, and detected constituents and associated concentrations and analytical qualifiers. The file is then transferred to an AutoCAD work station, where another program has been developed to plot a location's analytical data in a "box" format at the sample location (represented by the state plane coordinates). This routine greatly reduces the redundant keypunching of analytical results and facilitates the efficient production of interpretative and presentation graphics.

The data management system also has the capability of producing a digital file of select parameters that exists in one or more of the databases. This type of custom function is accomplished on an interactive basis and is best used for transferring select information into a number of analysis tools, such as statistical or graphing programs.

16.4.6 Document Control and Inventory

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

1. Agreements/Proposals (filed chronologically)
2. Change Orders/Purchase Orders (filed chronologically)
3. Invoices (filed chronologically)
4. Project Management (filed by topic)
5. Correspondence (filed chronologically)
6. Notes and Data (filed by topic)
7. Public Relations Information (filed by topic)
8. Regulatory Documents (filed chronologically)
9. Marketing Documents (filed chronologically)
10. Final Reports/Presentations (filed chronologically)
11. Draft Reports/Presentations (filed chronologically)
12. Documents Prepared by Others (filed chronologically)

Originals, when possible, are placed in the files. These are the central files and will serve as the site-specific files for the annual groundwater sampling activities.

17. Assessment and Response Actions

17.1 General

Performance and systems audits will be completed in the field and laboratory during the annual groundwater sampling activities as described below.

17.2 Field Audits

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

17.3 Laboratory Audits

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

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

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

17.4 Corrective Action

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

17.4.1 Field Procedures

When conducting the action field work, if a condition is noted that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action implemented will be documented on a Corrective Action Form (Attachment 1) and reported to the appropriate ARCADIS Task Manager, QAM, and Project Manager.

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

- Protocols as defined by the QAPP, SMP, and FSP have not been followed
- Equipment is not in proper working order or is not properly calibrated
- QC requirements have not been met
- Issues resulting from performance or systems audits have not been resolved

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

17.4.2 Field Procedures

In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action to be taken will be documented and reported to the appropriate project manager and QAM.

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

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

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

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

18. Reports to Management

The QAM will audit the implementation of the QAPP. Each project component will result in some type of QA report or, by its absence, acknowledge that no significant QA or QC deviations occurred. Items that may result in a QA report include:

- Changes or updates to the QAPP
- Deviations from QAPP or SMP specification
- The results of system and performance audits
- Significant QA/QC problems, recommended solutions, and the results of corrective actions
- Limitations on the use of measurement data

18.1 Field Reports

Reporting of the quality of field sample collection and field measurements will be the responsibility of the Field Supervisor or designee. Information from the field logbooks will be compiled and a summary report on field activity QA will be prepared for the project file.

18.2 Laboratory Reports

The laboratory will maintain QA records related to analyses, quality control, and corrective action. This information will be made available to the Project Manager upon request. Routine reporting will include documenting of all internal quality control checks performed for this project.

19. Data Reduction and Review

19.1 General

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

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

19.2 Field Data Reduction and Review

19.2.1 Field Data Reduction

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

19.2.2 Field Data Review

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

- General completeness
- Readability
- Usage of appropriate procedures
- Appropriate instrument calibration and maintenance

- Reasonableness in comparison to present and past data collected
- Correct sample locations
- Correct calculations and interpretations

19.3 Laboratory Data Reduction and Review

19.3.1 Laboratory Data Reduction

The calculations used for data reduction will be specified in each of the analytical methods referenced previously. Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. Raw data will be entered into permanently bound laboratory notebooks. The data entered are sufficient to document all factors used to arrive at the reported value.

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

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

Non-aqueous values will be reported on a dry-weight basis. Unless otherwise specified, all values will be reported uncorrected for blank contamination.

19.3.2 Laboratory Data Review

Data will be subject to multi-level review by the laboratory. The group leader will review all data reports prior to release for final data report generation. The QAM will review the final data reports, and the laboratory director will review a cross section of the final data reports prior to shipment to ARCADIS.

If discrepancies or deficiencies exist in the analytical results, then corrective action will be taken, as discussed in Section 17. Deficiencies discovered as a result of internal data review, as well as the corrective actions to be used to rectify the situation, will be documented on a Corrective Action Form. This form will be submitted to the ARCADIS Project Manager.

19.4 Data Validation and Verification

All data generated for health and safety and engineering design/control purposes will be subjected to the data validation and verification procedures outlined in Section 20. Data generated for disposal purposes will not be reviewed.

20. Data Validation and Verification

Analytical data for the soil and groundwater samples will be evaluated using either the Data Usability Summary Report (DUSR) format or full analytical data validation. The DUSR will be utilized for routine characterization samples and that data validation will be completed for specific groups of samples that are used to support conclusions or recommendations. The decision whether to utilize the DUSR or data validation for each sample delivery group will be made by Niagara Mohawk's project manager based on the anticipated use of the analytical results.

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

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or as specified in this QAPP. Any deviations from the analytical method or any special reporting requirements apart from that specified in this QAPP will be detailed on COC forms.

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

- Evaluate completeness of data package

- Verify that field COC forms were completed and that samples were handled properly

- Verify that holding times were met for each parameter. Holding time exceedences, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis

- Verify that parameters were analyzed according to the methods specified

- Review QA/QC data (i.e., make sure duplicates, blanks, and spikes were analyzed on the required number of samples, as specified in the method; verify that duplicate and matrix spike recoveries are acceptable)

- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the project manager and/or laboratory manager, as appropriate

- If data appears suspect, investigate the specific data of concern. Calculations will be traced back to raw data; if calculations do not agree, the cause will be determined and corrected

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written report.

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean producing data without QC qualifiers. Qualified data can provide useful information.

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

Upon completion of the validation of each sample delivery group/parameter, a data validation report addressing the following topics (as applicable to each method) will be prepared:

- Assessment of the data package;
- Description of any protocol deviations;
- Failures to reconcile reported and/or raw data;
- Assessment of any compromised data;
- Overall appraisal of the analytical data; and
- Table of site name, sample quantities, matrix, and fractions analyzed.

Following completion of data validation reports for all sample delivery groups/parameters, ARCADIS will prepare a data usability report that will present a detailed analysis of whether the data generated by implementation of the annual groundwater sampling activities achieves the DQOs. The data validation/usability reports will be included as an appendix to the Annual Review Report, if appropriate. The data validation/usability reports will be kept in the project file at the ARCADIS office in Syracuse, New York.

21. Reconciliation with User Requirements

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

- Retrieval of missing information
- Request for additional explanation or clarification
- Reanalysis of sample from extract (when appropriate)
- Recalculation or reinterpretation of results by the laboratory

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

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

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

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

- Additional sample collection and analysis.

ARCADIS

Tables

TABLE 1

NATIONAL GRID
ALBANY (gRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

METHOD REPORTING LIMITS AND ACTION LIMITS

Analyte	Water (ug/L) Laboratory MDL	Water (ug/L) Laboratory RL
Volatile Organic Compounds 8260 [1]		
1,1,1-Trichloroethane	0.37	10
1,1,2,2-Tetrachloroethane	0.11	10
1,1,2-Trichloroethane	0.17	10
1,1-Dichloroethene	0.24	10
1,2 Dichloroethane	0.11	10
1,2,4-Trichlorobenzene	0.3	10
1,2-Dibromo-3-chloropropane (DBCP)	0.31	10
1,2-Dibromoethane (EDB)	0.16	10
1,2-Dichlorobenzene	0.14	10
1,2-Dichloropropane	0.17	10
1,3-Dichlorobenzene	0.17	10
1,4-Dichlorobenzene	0.2	10
2-Butanone (MEK)	1.98	10
2-Hexanone	1.09	10
4-Methyl-2-pentanone (MIBK)	1.13	10
Acetone	1.89	10
Benzene	0.2	10
Bromoform	0.24	10
Bromomethane	0.32	10
Carbon Disulfide	0.26	10
Carbon Tetrachloride	0.39	10
Chlorobenzene	0.08	10
Chloroethane	0.46	10
Chloroform	0.17	10
cis-1,2-Dichloroethene	0.22	10
cis-1,3-Dichloropropene	0.23	10
Cyclohexane	0.39	10
Dibromochloromethane	0.17	10
Dichlorobromomethane	0.08	10
Dichlorodifluoromethane	0.4	10
Ethylbenzene	0.18	10
Isopropylbenzene	0.26	10
Methyl Acetate	0.47	10
Methyl Chloride	0.54	10
Methyl t-butyl ether (MTBE)	0.29	10
Methylcyclohexane	0.38	10
Methylene Chloride	0.13	10
Styrene	0.16	10
Tetrachloroethene	0.39	10
Toluene	0.17	10
Total Xylenes	0.62	10
trans-1,2-Dichloroethene	0.21	10
trans-1,3-Dichloropropene	0.09	10
Trichloroethene	0.25	10
Trichlorofluoromethane	0.35	10
Vinyl Chloride	0.38	10

Notes:

1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste SW-846 3rd ed. Washington, D.C. 1996.*
2. The target reporting limits are based on wet weight. The actual reporting limits will vary based on sample weight and moisture content.
3. The reporting limits listed are the Maximum Concentration of Contaminants for the Toxicity Characteristic (Fed. Reg.)

TABLE 2

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

ESTIMATED QUANTITY OF ENVIRONMENTAL AND QUALITY CONTROL SAMPLES

Parameters	Estimated Environmental Sample Quantity	Field QC Analysis						Laboratory QC Analysis								Estimated Total (Per Year)
		Trip Blank		Field Duplicate		Rinse Blank		MS		MSD		MSB		Lab Duplicate		
		Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Groundwater Sampling																
TCL VOCs	7 per year	1/day	3	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	--	--	15
Waste Characterization Sampling																
PCBs	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP VOCs	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP SVOCs	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP Inorganics	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Reactivity	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Corrosivity	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ignitability	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1

TABLE 3

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

ESTIMATED ENVIRONMENTAL SAMPLE QUANTITIES

Parameters	SW-846 Analytical Method	Estimated Sample Quantity (Per Year)
Groundwater Sampling		
TCL VOCs	NYSDEC ASP SW-846 8260B	7
Waste Characterization Sampling		
PCBs	NYSDEC ASP SW-846 8082	1
TCLP VOCs	NYSDEC ASP SW-846 1311/8260B	1
TCLP SVOCs	NYSDEC ASP SW-846 1311/8270C	1
TCLP Metals	NYSDEC ASP SW-846 1311/6010/747(	1
Reactivity	NYSDEC ASP SW-846 Chapter 7.3	1
Corrosivity	NYSDEC ASP SW-846 Method 9045	1
Ignitability	NYSDEC ASP SW-846 Method 1030	1

Notes:
1. PCBs - Polychlorinated biphenyls
2. TCL - Target Compound List
3. VOCs - Volatile Organic Compounds
4. SVOCs - Semi-Volatile Organic Compounds
5. TAL - Target Analyte List
6. TCLP - Toxicity Characteristic Leaching Procedure
7. NYSDEC ASP- New York State Department of Environmental Conservation Analytical Services Protocol

TABLE 4

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

ANALYTICAL QUALITY CONTROL (QC) LIMITS

Parameter	Accuracy - % Recovery			Precision - RPD			Method Blanks
	Surrogate	MS/MSD	LCS	MS/MSD	Lab Duplicate	Field Duplicate	
Groundwater							
Volatile Organics	75-115	60-145	70-140	20	--	30	Below Detection Limit (where applicable)
Semivolatile Organics	20-140	20-130	40-120	40	--	30	
Metals	--	80-120	80-120	--	30	30	

Notes:

1 The listed QC limits are based on SW-846 guidance and are advisory. The actual limits are determined based on laboratory performance. Frequent failure to meet the QC limits; however, warrant investigation of the laboratory.

TABLE 5

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Method	Bottle Type	Preservation	Holding Time
Water Samples				
TCL VOCs	8260	(2) 40 mL glass vials with Teflon-lined lid	HCl to pH<2, Cool to 4°C	14 days to analysis
Waste Characterization Samples				
TCLP VOCs	1311 / 8260	(1) 125 mL widemouth glass container, cap lined	Cool to 4°C	14 days to analysis
TCLP SVOCs	1311 / 8270	(1) 250 mL widemouth glass container, cap lined with Teflon	Cool to 4°C	14 days to analysis
TCLP Metals	1311 / 6010 / 7470		Cool to 4°C	14 days to analysis
Reactivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Corrosivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Ignitability	SW-846 Chapter 7		Cool to 4°C	No holding time
PCBs	8082		Cool to 4°C	14 days to extraction 40 days to analysis

Notes:
1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*
2. All holding times are measured from date of collection.
3. NS - Not Specified
4. NA - Not Applicable
5. VOC - Volatile Organic Compounds
6. SVOC - Semi Volatile Organic Compounds
7. PCBs - Polychlorinated Biphenyls
8. TCLP - Toxicity Characteristic Leaching Procedure

TABLE 6

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

FIELD INSTRUMENT PREVENTATIVE MAINTENANCE SUMMARY

Maintenance	Frequency
Turbidity Meter	
Store in protective casing	D
Inspect equipment after use	D
Clean sample cells	D
Clean lens	M or X
Check and recharge batteries	D
Keep log book on instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D
Conductivity, pH, Dissolved Oxygen	
Meters	D
Store in protective casing	D
Inspect equipment after use	D
Clean probe	D
Keep log book in instrument	D
Have replacement meter available	X
Replace probes	X
Return to manufacturer for service	D
Calibration	
Thermometer	
Store in protective casing	D
Inspect equipment after use	D
Have a replacement thermometer	D
available	
Water Level Meter	
Store in protective covering	D
Inspect equipment after use	D
Check indicators/batteries	D
Keep log book on instrument	D
Have a replacement meter available	X
Photoionization Detector	
Store in protective casing	D
Inspect equipment after use	D
Check and recharge batteries	D
Clean UV lamp and ion chamber	M or X
Keep log book on instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D

Notes:
D - Daily
M - Monthly
X - Operator's discretion

TABLE 7

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

FIELD INSTRUMENT CALIBRATION FREQUENCY SUMMARY

Equipment	Calibration Check	Calibration Standard	Calibration Standard Holding Time
pH Meter	Prior to use - daily[1]	pH 4.0 pH 7.0 pH 10.0	One Month
Conductivity Meter	Prior to use - daily	1,000 mg/l Sodium Chloride	One Month
Water Level Meter	Prior to implementing field work	100-foot engineer's tape	N/A
Dissolved Oxygen Meter	Per sampling event	Air	N/A
Turbidity	Prior to use - daily	Formazin 0.5 NTU, 5.0 NTU, 40.0 NTU	N/A
PID	Prior to use - daily	Isobutylene	N/A

Notes:

1. [1] - The pH meter will also be calibrated at each well prior to ground water sampling.
2. N/A - not applicable.
3. NTU - nephelometric turbidity units.
4. mg/l - milligrams per liter.

TABLE 8

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

<u>FIELD MEASUREMENT QUALITY CONTROL SUMMARY</u>

Field Parameter	Precision [1]	Accuracy
Water Temperature	. 1ºC	. 1ºC instrument capability
pH	. 0.1 S.U.	. 0.1 S.U. (instrument capability)
Conductivity	. 0.01 mS/cm	. 5% standard
Dissolved Oxygen	. 0.02 mg/l	. 5%
Turbidity	. 1.0 NTU	. 2% standard
Water Level	. 0.01 foot	. 0.01 foot

<u>Notes</u>:

1. [1] - Precision units presented in applicable significant figures.
2. S.U. - standard units.
3. mS/cm - millisiemens per centimeter.
4. mg/l - milligrams per liter.

TABLE 9

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN
ELECTRONIC DATA DELIVERABLE FORMAT

Field Name	Maximum Length	Data Type	Comments
FIELD SAMPLE ID	50	TEXT	From the chain of custody. Add "RE" or "DL" to differentiate reanalyses and dilutions.
SDG	50	TEXT	
LAB SAMPLE ID	50	TEXT	
MATRIX	10	TEXT	SOIL, WATER, SEDIMENT, etc.
SAMPLE TYPE	10	TEXT	FB, RB, TB, FD, FS for Field Blank, Rinse Blank, Trip Blank, Field Duplicate and Field Sample, respectively. DEFAULT TO FS
DATE COLLECTED	--	DATE/TIME	MM/DD/YY
TIME COLLECTED*	--	DATE/TIME	Military time
DEPTH START	--	NUMBER	
DEPTH END	--	NUMBER	
DEPTH UNITS	25	TEXT	FEET, INCHES, METERS, etc.
ANALYTICAL METHOD	50	TEXT	
CAS NUMBER	25	TEXT	
ANALYTE	100	TEXT	
RESULT VALUE	--	NUMBER	For non-detected results, enter Reporting Limit ("U" must be present in Lab Qualifier field).
LAB QUALIFIER	10	TEXT	"U" for non-detected, others as defined by laboratory.
REPORTING LIMIT	--	NUMBER	
RESULT UNIT	25	TEXT	
DILUTION FACTOR	--	NUMBER	
REPORTABLE RESULT	--	YES/NO	DEFAULT TO YES
FILTERED?	--	YES/NO	
DATE ANALYZED	--	DATE/TIME	MM/DD/YY
TIME ANALYZED*	--	DATE/TIME	Military time
DATE EXTRACTED	--	DATE/TIME	MM/DD/YY
LABORATORY NAME*	50	TEXT	

Notes:
This definition is for an "Excel-type" spreadsheet. Fields flagged with an "*" are optional and may be left blank if not available electronically from the laboratory.
Depth-related fields may be left blank for samples and matrices for which they are not applicable.

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Attachment 1

Corrective Action Form

ATTACHMENT 1

NATIONAL GRID
ALBANY (GRAND STREET) NON-OWNED FORMER MGP SITE
ALBANY , NEW YORK

CORRECTIVE ACTION FORM

Corrective Action No.: ________________________________ Date: ______________

To: ____ cc: Task Manager

You are hereby requested to take corrective actions indicated below and as otherwise determined by you (A) to resolve the noted condition, and (B) to prevent it from recurring. Your written response is to be returned to the Quality Assurance Manager (QAM).

Condition

Reference Documents

Recommended Corrective Actions

Originator Date	QAM Approval Date	P.M. Approval Date

Response

Corrective Action

A. Resolution
B. Pretention
C. Affected Documents

Signature: ____________________________________ Date: ______________

Follow-up:

Corrective Action Verified:

By: ____ Date: ______________

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Appendix I

Stormwater Pollution Prevention Plan

Imagine the result

Appendix I

Stormwater Pollution Prevention Plan (SWPPP)

Albany (Grand Street) Non-Owned Former MGP Site

June 2012

ARCADIS

Table of Contents

1. Introduction

1.1 General

This Stormwater Pollution Prevention Plan (SWPPP) has been prepared to describe stormwater management practices that will be implemented to control potential impacts (e.g., erosion, sediment loading, etc.) of stormwater runoff associated with the intrusive activities at the National Grid Albany (Grand Street) non-owned former manufactured gas plant (MGP) site (the “site”). The site is located at the northeast corner of Grand Street and Arch Street in Albany, New York. The geographic location of the site is shown on the site location map included on Figure 1 of the Site Management Plan (SMP). The general layout of the site is illustrated on Figure 2 of the SMP.

This SWPPP has been prepared in accordance with the requirements and standards outlined in the latest editions of the New York State Department of Environmental Conservation (NYSDEC) document, *New York Standards and Specifications for Erosion and Sediment Control* (NYSDEC, 2005) (New York Standards for Erosion and Sediment Control).

The stormwater management objectives identified for intrusive activities are:

- Minimize the potential for migration of soil/sediments and conveyance of sediment-laden surface runoff to downgradient off-site areas such that there is no increase in turbidity that will cause a significant and visible contrast to naturally occurring conditions;

- Minimize the accumulation of water within active excavation areas to facilitate completion of excavation and backfilling activities;

- Minimize the generation of fugitive dust and oil, grease, or other substances from construction vehicles; and

- Minimize the potential for tracking of sediments to off-site areas.

2. Background Information

A summary of background information associated with the site is presented below.

2.1 Site Description

The Site is bordered by Grand Street to the west, residential buildings and a multistory apartment building (the Schuyler Apartments, which was previously a school) to the north, Trinity Place to the east, and Arch Street to the south. The National Grid Trinity Substation occupies the northern portion of the Grand Street parcel and vacant multistory industrial buildings (the former F. Jacobson & Sons Shirt Factory) occupy the southern portion of the parcel. One of the vacant buildings along Grand Street (95 Trinity Place as shown on Figure 2 of the Site Management Plan) was recently purchased by the Capital City Rescue Mission and current plans included developing the building into 44 temporary residence/itinerant apartments. The Trinity Substation is surrounded by an approximately 10-foot-high concrete wall. Access to the substation is restricted by locked gates located in the southwest (along Grand Street) and northeast (along Trinity Place) corners of the substation. Access to the southern portion of the parcel (the industrial buildings) is limited, with the exception of one driveway located along Arch Street which services a loading dock on the north side of the building.

2.2 Site History

A detailed discussion site history is presented in Section 1.2.,2 of the SMP. The Albany (Grand Street) non-owned former MGP site is comprised of the former operations of the Albany Gas Light Company. Available historical information indicates that the original MGP operation was located on the Grand Street parcel of the site and that the parcels located north and south of Park Avenue were utilized for gas holders. A detailed discussion site history is presented in Section 1.2.2 of the SMP.

2.3 Site Conditions

The site is located in the Hudson-Mohawk Lowlands. Glacial Lake Albany covered the eastern third of Albany County from approximately 16,000 to 12,600 years ago (USDA SCS, 1992). The City of Albany was built on Lake Albany clay, which rests on an irregular rock surface with an apparent deep depression directly under the City of Albany (Ruedmann, 1930). Subsurface lithology encountered at the site generally consisted of various fill deposits (including silt and clay, sand, concrete, brick, wood, cinders, ash, coal, etc.), typically 10 to 20 feet thick; overlying 10 to over 40 feet of glaciolacustrine clay/silt deposits (described as gray-brown clayey silt to silty clay, moderately plastic, with occasional interbedded silt/fine sand) and till (described as brown gray sandy silt/clay, non-plastic, with some gravel). Bedrock was not encountered during the field activities.

Based on topography, shallow groundwater is encountered in the overburden and flows generally to the south/southeast in the vicinity of the site. Localized flow variations may occur due to anthropogenic influences (e.g., utilities, sumps, pumping, etc.). The Hudson River, located approximately 2,000 feet east/southeast of the site is a regional discharge point for groundwater. Groundwater was encountered within the fill or the glaciolacustrine clay unit at depths ranging from approximately 8 to 29 feet bgs.

3. Erosion and Sediment Control

The contractor will be responsible for installing and maintaining all temporary erosion and sediment control measures (e.g. silt fence, inlet protection, and dust control) that may be required during construction, in accordance with the NYSDEC Standards and Specifications. Temporary erosion and sediment control measures will be installed prior to any significant soil disturbance activities at the site. The contractor will be responsible for providing additional erosion and sediment control measures, as needed, to achieve the stormwater management objectives for the intrusive activities. These temporary erosion and sediment control measures will be left in place and maintained until completion of the intrusive activities and site restoration. Transport of sediment from the active work areas will be controlled to the extent possible in order to reduce the potential for impacts to the stormwater system and downgradient water bodies. Brief descriptions of the typical erosion and sediment control practices that will be installed and maintained as part of site construction activities are presented in the following subsections.

3.1 Erosion and Sediment Control Measures

Reinforced Silt Fence – Reinforced silt fence will be installed along the perimeter of the proposed area of disturbance . Silt fencing will be installed prior to any earth moving activities to provide control of sediment once bare earth is exposed. The silt fencing will be inspected weekly and/or after significant storm events (rainfall in excess of 0.5 inches in a 24-hour period). Damaged fabric and/or collapsed posts will be repaired/replaced promptly by the Contractor. Sediment deposits will be removed when they reach a depth of one-half the height of the silt fence.

Inlet Protection – Temporary concrete block/gravel filter inlet protection will be installed at storm sewer inlets prior to commencing remedial activities, and will remain intact throughout the duration of the remedial activities. The catch basin inlet protection will be inspected weekly, and will be replaced when damaged; sediment depths reach one-half the height of the storm sewer inlet protection; or at the request of the Engineer.

Dust Control – Water will be applied to exposed soils on an as-needed basis during the construction activities to reduce the potential for dust generation without causing soil erosion. Additional dust control measures, as needed, will be implemented to minimize dust generation from excavation, loading, and unloading activities. It is anticipated that excavated soils may be stockpiled onsite prior to being transported for offsite disposal. Material being transported to onsite locations or for offsite disposal will be covered, as necessary, prior to transport to further reduce the potential for dust generation.

Equipment Decontamination – Decontamination areas will be constructed within and adjacent to the limits of work to reduce the potential for tracking soil materials throughout the site and/or to offsite areas during construction. Decontamination activities will consist of thoroughly brushing the tires/tracks and undercarriages of any vehicles and equipment with visible deposits of soil prior to exiting the work areas and/or by wet washing any vehicles/equipment whose wheels, tracks, and/or undercarriages have contacted potentially impacted soil material. Washwater from the decontamination areas will be collected and containerized for offsite disposal in accordance with applicable regulations.

Good Housekeeping – Good housekeeping practices will be implemented to minimize the potential for impacted materials to be mobilized via stormwater discharges from the site. During construction, the contractor will be responsible for maintaining the site in a neat and orderly condition. This will include, but may not be necessarily limited to: routine waste management activities, including the collection and disposal of trash, rubbish, construction waste and sanitary wastes; prompt cleanup of decontamination residues, prompt cleanup of spills of liquid or dry materials (if any); and prompt cleanup of any soil/sediments tracked by construction vehicles and/or transported by wind or stormwater from active work areas to other areas of the site or nearby offsite areas.

3.2 Inspection and Maintenance of Erosion and Sedimentation Controls

Throughout the duration of the project, erosion and sediment control measures will be inspected and maintained and/or modified by the contractor, as necessary, to retain their intended functionality. At a minimum, the erosion and sediment control measures will be inspected once per week and/or immediately following significant rain events (greater than or equal to 0.5 inches of rainfall in a 24-hour period). The erosion and sediment control measures will be maintained for the duration of the project until such time that all permanent stabilization measures have been fully established.

3.3 Site Restoration

Upon completion of intrusive activities the cover system will be restored in a manner that complies with the SMP. A final site inspection will be performed and documented to verify that all disturbed areas are suitably stabilized and restored. Following successful completion of the final site stabilization, the contractor will remove any temporary erosion and sediment control features that are no longer needed (e.g., silt fencing), as appropriate. Once removed, temporary erosion and sediment control measures will be disposed of offsite in accordance with applicable regulations.

4. References

New York State Department of Environmental Conservation. 2005. *New York Standards and Specifications for Erosion and Sediment Control.* August 2005.

New York State Department of Environmental Conservation. 2010. *New York State Stormwater Management Design Manual.*