FINAL

Former Hexagon Laboratories Site

BRONX COUNTY, NEW YORK

Site Management Plan

NYSDEC Site Number: 203003

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Revisions to Final Approved Site Management Plan:

Revision #	Submitted Date	Summary of Revision	DEC Approval Date

MARCH 2013

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1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 INTRODUCTION

This document is required as an element of the remedial program at the Former Hexagon Laboratories Site (hereinafter referred to as the "Site") under the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program administered by New York State Department of Environmental Conservation (NYSDEC). The site (NYSDEC Site No. 203003) was split into two operable units for remediation (Operable Unit [OU]-1, soils remedy, and OU-2, groundwater remedy). OU-1 was remediated in accordance with Order on Consent Index #01-CIV-0668, Site No. 203003, which was executed in July 2003. OU-2 was remediated by NYSDEC in accordance with work assignments to a standby consultant and standby contractors under contract to NYSDEC within their Inactive Hazardous Waste Disposal Site Remedial Program.

1.1.1 General

The Settling Parties to the Consent Decree entered into an Order on Consent with NYSDEC to remediate a 0.8-acre property located in the Eastchester section of Bronx County, New York. This Order on Consent required the Remedial Party, to remediate contaminated soil at the site. NYSDEC attempted the remediation of groundwater at the site under the Inactive Hazardous Waste Disposal Site Remedial Program. A figure showing the site location and boundaries of this 0.8-acre "Site" is provided as Figure 1-1.

After completion of the remedial work described in the Record of Decision (ROD) for OU-1, Soils, and the ROD for OU-2, Groundwater, some contamination was left in the subsurface soils and in the groundwater at this site, which is hereafter referred to as "remaining contamination." This Site Management Plan (SMP) was prepared to

manage remaining contamination at the site until the Environmental Deed Restriction is extinguished in accordance with Environmental Conservation Law (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 Ecology and Environment Engineering, P.C. (EEEPC), on behalf of NYSDEC, in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May, 2010, and the guidelines provided by NYSDEC. This SMP addresses the means for implementing the Institutional Controls (ICs) and Engineering Controls (ECs) that are required by the Environmental Deed Restriction for the site.

1.1.2 Purpose

The site contains contamination left after completion of the remedial action. Engineering Controls 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. An Environmental Deed Restriction granted to NYSDEC, and recorded with the Bronx 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 maintenance, monitoring and reporting measures for all ECs and ICs. This SMP specifies the methods necessary to ensure compliance with all ECs and ICs required by the Environmental Deed Restriction for contamination that remains at the site. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Deed Restriction and the grantor's successors and assigns. This SMP may only be revised with the approval of NYSDEC.

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

To address these needs, this SMP includes two plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; and (2) a Monitoring Plan for implementation of Site Monitoring.

This plan also includes a description of Periodic 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 Environmental Deed Restrictions. Failure to properly implement the SMP is a violation of the Environmental 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, 6 New York Codes, Rules and Regulations (NYCRR) Part 375 and the Order on Consent (Index #01-CIV-0668; Site #203003) for the site, and thereby subject to applicable penalties.

1.1.3 Revisions

Revisions to this plan will be proposed in writing to NYSDEC's project manager. In accordance with the Environmental Deed Restrictions for the site, 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 site is located in the Eastchester Section, County of Bronx, New York and is identified as Tax Lot: 17-5283-43 on the Bronx County Tax Map. The site is an approximately 0.8-acre area bounded by Boston Road to the northwest; Tufo's Wholesale Dairy and parking area, and Heathcote Avenue to the northeast; Marbo Used Auto Parts and an unnamed construction equipment and materials storage yard to the southeast; and Peartree Avenue to the southwest (see Figure 1-1).

1.2.2 Site History

Hexagon Laboratories made pharmaceuticals, pharmaceutical intermediates, and a large array of other organic chemicals from the mid-1940s through 1988. Products were primarily manufactured in batch-size quantities using batch reactors and distillation units. A wide array of raw materials and chemicals were used in manufacturing operations at

the site and a wide variety of finished products and wastes were generated by those operations. Hexagon was also a hazardous waste generator, transporter, storage, and disposal facility.

The facility had a history of chemical spillage as far back as the 1980s when there were complaints to local elected officials about dumping by Hexagon Laboratories. Complaints of strong odors and liquids seeping from the site along the Hexagon property line were first made to NYSDEC by Bronx Auto Wrecking and Salvage, Inc., in 1980. The site was inspected several times by state and local environmental regulators in response to complaints. From 1981 through 1988 there were numerous violations of federal, state, and local laws at the site including missing United States Environmental Protection Agency (EPA) hazard codes, missing manifests, unlabeled waste drums, and spilled chemicals. A site inspection report prepared in 1988 included a no further remedial action planned (NFRAP) recommendation. The hazard ranking system (HRS) scoring for the site was 3.48; a score of 28.5 is the minimum for the site to be listed on the federal National Priorities List (i.e., as a Superfund Site).

In 1986 NYSDEC directed Hexagon to install monitoring wells and conduct groundwater sampling in response to past releases from their site. The plant was closed before a plan could be implemented.

In 1990, the New York City Police Department Bomb Squad removed a number of explosives and reactives from the site, and in 1992, the EPA initiated an emergency removal action. The removal action, completed in April 1993, included removal of hazardous wastes and substances from drums and tanks (including process vessels and fuel oil tanks), as well as smaller containers (pails and laboratory chemicals) and obvious waste piles on the floors of buildings.

In 1996, as a preliminary step in the Remedial Investigation/Feasibility Study (RI/FS), a structural evaluation of the Hexagon Laboratories buildings was conducted. The results of the evaluation concluded that, for safety-related reasons, several of the buildings should be demolished prior to initiating the planned intrusive investigative activities in and around these buildings. As a result, an Interim Remedial Measure (IRM), consisting of demolition of four of the seven buildings on site, asbestos abatement of these structures and the yard areas, removal of 47 aboveground storage tanks (ASTs)/reactor vessels, and removal of 30 underground storage tanks (USTs) was taken. The IRM began in July 1997 and was completed in January 1998.

Phase 1 RI field activities were initiated in November 1997 and were completed in April 1999, which included a topographic survey; a geographical survey; collection of surface soil and miscellaneous (oily material) samples; drilling of exploratory borings and collection of subsurface soil samples; collection of UST excavation sidewall samples; installation and sampling of six groundwater monitoring wells; and an ecological investigation. As part of Phase 2 RI to supplement the earlier sampling effort, an additional seven new groundwater monitoring wells were installed during May and June 1999.

A Focused Feasibility Study (FFS) addressing the soil contamination above the groundwater table (OU-1) was completed in 1999. A ROD was signed in February 2000 for OU-1, which called for excavation and removal of contaminated soil to 6 feet below ground surface (bgs), bedrock, or water table. The FFS assumed that the soil remediation would be completed prior to groundwater remediation.

1.2.3 Geologic Conditions

The Hexagon Laboratories Site is located in the northeast corner of Bronx County, New York, approximately 700 feet southwest of the Hutchinson River. The geology of Bronx County includes near-surface glacial deposits, and metamorphic and sedimentary bedrock. The unconsolidated deposits beneath the site consist of Upper Pleistocene glacial till which was deposited directly from melting ice in an extensive ground moraine. The till, which covers most of Bronx County, is poorly sorted and consists of brown, unsaturated clay, sand, and boulders. The eastern two-thirds of Bronx County, including the Hexagon Laboratories Site, is underlain by Manhattan Schist, a dark-green to black, micaceous metamorphic rock. The geologic structure of the Manhattan Schist is complex. The formation is intensely folded and metamorphosed, with well-developed foliation. A geologic cross-section is shown in Figure 1-2.

As indicated in Figure 1-2, depth to bedrock is very shallow across most of the site. Bedrock is closest to the surface near the Office/Warehouse building at MW-6 where it was encountered at a depth of 1 foot bgs. Depth to bedrock along Peartree Avenue appears to be approximately 5 to 6 feet bgs. The bedrock surface beneath the North Yard and the Old Plant appears to rise to the north towards Tufo's Wholesale Dairy to a depth of 2 to 3 feet bgs. In the East Yard, the bedrock surface appears to drop off steeply as evidenced by the bedrock elevation at MW-1 and MW-2 of 11 feet National Geodetic Vertical Datum (NGVD), 20 feet lower than encountered at MW-3 in the South Yard. Given the proximity of the Hutchinson River to the site, it is possible

that the steep drop-off in bedrock surface can be attributed to erosion from a former paleochannel of the river.

Based on the topography of the site, it appears that surface water runoff from the site is diverted to the combined sanitary/storm sewers which extend along Hollers Avenue and Boston Post Road. The combined sewers transport storm water runoff to a wastewater treatment plant during periods of low flow. However, during high-flow storm events, the combined stormwater/sanitary sewers discharge directly to the Hutchinson River.

Groundwater elevation data collected as part of the RI indicates that groundwater is present in the overburden across the entire site with the exception of MW-6. Groundwater at MW-6 is first encountered at a depth of approximately 2 to 3 feet below the top of bedrock suggesting that the groundwater table at the site crosses the soil/bedrock interface between MW-5 and MW-6. In addition, it appears that horizontal groundwater flow is generally in an easterly direction across the site. However, the groundwater elevation data also indicate groundwater flow to the northwest at the northern end of the site, suggesting the possible presence of a groundwater divide in the vicinity of monitoring well MW-5 separating groundwater flow at the site. Comparison of groundwater elevations in the colocated shallow (overburden) and deep (bedrock) monitoring wells in the East Yard indicates that groundwater within the bedrock is hydraulically connected to the overburden aquifer. A groundwater flow figure is shown in Figure 1-3.

1.3 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

An RI was performed to characterize the nature and extent of contamination at the site. The results of the RI are described in detail in the following reports:

- *Final Remedial Investigation Report: Hexagon Laboratories*, TAMS Consultants, Inc., 1999.
- *Final OU-2 Remedial Investigation Report: Hexagon Laboratories*, TAMS Consultants, Inc., 2001.

Generally, the RI determined that soil cleanup objectives (SCOs) were exceeded in surface and subsurface soils.

Below is a summary of site conditions when the RI was performed in 1996 to 1998:

Soil

Surface Soil

Surface soil contamination consists primarily of semivolatile organics (SVOCs), in particular, polycyclic aromatic hydrocarbons (PAHs). Chrysene is the most pervasive of the PAHs; it was detected in nine of the 16 surface and shallow subsurface soil samples at concentrations greater than NYSDEC recommended soil cleanup objectives (RSCOs). The highest concentrations of PAHs were observed in a shallow subsurface soil sample collected beneath the floor slab of Hydrotherm No. 1 in the vicinity of an apparent oil spill. Phenolic compounds were detected in one of the 16 samples at concentrations greater than NYSDEC RSCOs. Volatile organic compounds (VOCs) were also detected, and, in one sample, toluene, ethylbenzene, and xylenes (BTEX), trichloroethene, tetrachloroethene, acetone, and chlorobenzene exceeded NYSDEC RSCOs. Acetone was also detected at a concentration greater than the NYSDEC RSCO in one other shallow subsurface soil sample. Significant concentrations of unidentified VOCs and SVOCs (i.e., tentatively identified compounds [TICs]) were also reported.

One pesticide, aldrin, was detected in two of the nine surface and shallow subsurface soil samples analyzed for pesticides at concentrations greater than the NYSDEC RSO (Phase II RI soil samples were not analyzed for pesticides). However, due to matrix interference and analytical problems, there is a high probability that the detected pesticides are false positives and do not accurately represent site conditions. PCBs were detected in one surface soil sample and in one shallow subsurface soil sample at concentrations greater than the NYSDEC RSCO.

Various metals were detected at concentrations greater than the evaluation criteria (i.e., the greater of the applicable background concentrations and NYSDEC RSCOs). Nickel appeared to be the most pervasive of the metals with exceedances in seven of the 16 surface and shallow subsurface soil samples. Both antimony and nickel appeared to be pervasive in the East Yard with exceedances detected in four of the six surface and shallow subsurface soil samples collected in the East Yard.

Subsurface Soil

Subsurface soil contaminants consisted predominantly of VOCs, primarily BTEX compounds (especially toluene), chlorinated aliphatics, and chlorobenzene, although

other VOCs were detected. SVOCs, primarily PAHs, were also detected in subsurface soil samples at varying concentrations. PAHs were detected at lower frequency and generally at lower concentrations than detected in the surface soil samples. Phenolic compounds were detected in 11 of the 27 subsurface soil samples analyzed for SVOCs (excluding three off-site subsurface soil background samples). Phthalates were detected in one subsurface soil sample at concentrations greater than the corresponding NYSDEC RSCOs. Other SVOCs, including 4-chloroaniline, 1,2-dichlorobenzne, dibenzofuran, and carbazole, were detected sporadically. Significant concentrations of VOC and SVOC TICs were also reported. Both VOCs and SVOCs exceeded applicable NYSDEC RSCOs in many samples.

Pesticides were reported as detected in many samples. Concentrations were generally low but still exceeded NYSDEC RSCOs in seven of the 24 on-site subsurface soil samples analyzed for pesticides. However, due to matrix interference and analytical problems, there is a high probability that detected pesticides are false positives and do not accurately represent site conditions. PCBs were detected in several samples but were, with one exception, less than the applicable NYSDEC RSCO.

Various metals were detected at concentrations greater than the evaluation criteria. Cadmium was detected at concentrations above background in six of the 27 on-site subsurface soil samples, and chromium and nickel were each detected at concentrations above background in five of the 27 on-site subsurface soil samples.

TOC concentrations were generally low, ranging from approximately 0.05% to 2.6% TOC, and the data suggest a trend of decreasing TOC with depth. A TPHC concentration of 0.12% was detected in the one on-site subsurface soil sample analyzed for this parameter.

Site-Related Groundwater

As described in the RI Report, groundwater samples were collected at the site to characterize the nature and extent of contamination.

Groundwater contaminants detected at the site were similar to those detected in the surface and subsurface soil. Observed contamination in the groundwater at the Site consists primarily of benzene, toluene, ethylbenzene, and xylenes (BTEX compounds), chlorinated volatile organics, chlorinated benzenes, acetone, phenolic compounds, and aniline compounds.

While the presence of SVOCs was less significant in the groundwater as compared to the surface and subsurface soil, several SVOCs (primarily phenolic compounds, 4-chloroaniline, and 1,2-dichlorobenzene) were detected at concentrations greater than the NYSDEC Class GA groundwater standards.

Various metals in the total (unfiltered) metals samples including antimony, barium, beryllium, chromium, copper, lead, mercury, nickel, selenium, thallium, and zinc were detected at concentrations greater than the NYSDEC Class GA groundwater standards. However, in the dissolved (filtered) samples, only antimony, barium, chromium, nickel, selenium, thallium, and zinc were detected at concentrations greater than NYSDEC Class GA groundwater standards.

VOCs were detected at concentrations greater than the NYSDEC Class GA groundwater standards in all six of the on-site monitoring wells, MW-1, MW-2, MW-3, MW-4, MW-5, and MW-8 (see Figure 1-1). The shallow wells (MW-1, MW-3, MW-4, MW-5, MW-6, MW-7, MW-9, and MW-11) were all screened between 2 and 6 feet to 12 to 16 feet deep. The deeper wells vary from MW-2 (screened from 40 to 50 feet bgs) to MW-8 (75 to 85 feet bgs). Highest concentrations were observed in monitoring well MW-3 (South Yard), monitoring wells MW-4 and MW-8 (New Plant shallow and deep wells, respectively), and monitoring well MW-5 (Old Plant). The maximum concentration of 1,1-dichloroethene was found in MW-3 at 200 parts per billion (ppb) (groundwater standard of 5 ppb). Several chemicals were detected at their maximum on-site concentrations in MW-4: 1,1-dichloroethane at 16,000 ppb (groundwater standard of 5 ppb); 1,2-dichloroethene at 30,000 ppb (groundwater standard of 5 ppb); chloroform at 22,000 ppb (groundwater standard of 7 ppb); 1,2-dichloroethane at 110,000 ppb (groundwater standard of 0.6 ppb); 1,1,1-trichloroethane at 270 ppb (groundwater standard of 5 ppb); trichloroethene at 10,000 ppb (groundwater standard of 5 ppb); tetrachloroethene at 9,200 ppb (groundwater standard of 5 ppb); toluene at 270,000 ppb (groundwater standard of 5 ppb); ethylbenzene at 4,400 ppb (groundwater standard of 5 ppb); and xylene at 19,000 ppb (groundwater standard of 5 ppb). Styrene was detected at a maximum concentration of 24 ppb (groundwater standard of 5 ppb) in MW-5. Several chemicals were detected at their maximum concentrations in MW-8; vinyl chloride at 1,400 ppb (groundwater standard of 2 ppb); methlyene chloride at 6,400 ppb (groundwater standard of 5 ppb); acetone at 590,000 ppb (groundwater standard of 50 ppb); and benzene at 45,000 ppb (groundwater standard of 0.7 ppb).

VOCs were detected at concentrations greater than the NYSDEC Class GA groundwater standards in four of six off-site monitoring wells (MW-6, MW-10, MW-11,

MW-12; see Figure 2). In general, VOC concentrations were lower in off-site wells than in on-site wells, except for MW-10 (deep well east of site). VOC concentrations in MW-10 were comparable to on-site monitoring wells MW-1 and MW-2. The maximum off-site concentrations of volatile organic chemicals were found in MW10: Chloroethane was found at 950 ppb (groundwater standard of 50 ppb); 1,1-dichloroethane was found at 6 ppb (groundwater standard of 5 ppb); 1,2-dichloroethane was found at 14 ppb (groundwater standard of 5 ppb); benzene was found at a maximum off-site concentration of 560 ppb (groundwater standard of 0.7 ppb); toluene at 65 ppb (groundwater standard of 5 ppb); chlorobenzene at 1,600 ppb (groundwater standard of 50 ppb); ethylbenzene at 20 ppb (groundwater standard of 5 ppb); and xylene at 14 ppb (groundwater standard of 5 ppb).

As with VOCs, the highest concentrations of on-site SVOC contamination were observed in monitoring wells MW-3, MW-4, MW-5, and MW-8. Relatively low levels of SVOCs were detected in monitoring wells MW-1 and MW-2. Several chemicals were found at their maximum concentrations in MW-4 including 1,2-dichlorobenzene, found at 260 ppb (groundwater standard of 4.7 ppb); nitrobenzene at 8,600 ppb (groundwater standard of 5 ppb); and naphthalene at 710 ppb (groundwater standard of 10 ppb). Several chemicals were found at their maximum concentrations in MW-8: phenol was found at 16,000 ppb (groundwater standard of 1 ppb); bis(2-chloroethyl)ether was found at 3,000 ppb (groundwater standard of 1 ppb); 2-methylphenol at 7,900 ppb (groundwater standard of 5 ppb); 4-methylphenol at 150,000 ppb (groundwater standard of 50 ppb); 4-chloroanaline at 360 ppb (groundwater standard of 5 ppb); and diethylphthalate at 450 ppb (groundwater standard of 50 ppb).

For off-site wells, SVOCs were detected at concentrations greater than the NYSDEC Class GA groundwater standards in three of six off-site monitoring wells (MW-7, MW-10, and MW-12). SVOC concentrations were comparable in these three wells and much lower than in on-site wells.

Phenol was found at a maximum off-site concentration in MW-10 at 14 ppb [groundwater standard of 1 ppb]. MW-7 contained several SVOC chemicals at their maximum off-site concentrations: 3,3-dichlorobenzidine was estimated to be 10 ppb (groundwater standard of 5 ppb); benzo (g,h,i)perylene was estimated to be 10 ppb (groundwater standard of 5 ppb); benzo(a)anthracene was estimated to be 10 ppb (groundwater standard of 0.002 ppb); chrysene was estimated to be 10 ppb (groundwater standard of 0.002 ppb); benzo(b)fluoranthene was estimated to be 10 ppb (groundwater standard of 0.002 ppb); benzo(k)fluoranthene was estimated to be 10 ppb (groundwater

standard of 0.002 ppb); benzo(a)pyrene was estimated to be 10 ppb (groundwater standard of 0.002 ppb); and indeno(1,2,3-c,d)pyrene was estimated to be 10 ppb (groundwater standard of 0.002 ppb).

Pesticides were detected sporadically in all on-site wells; these detections are considered suspect due to significant matrix interference. PCBs were detected in samples collected from New Plant shallow monitoring well MW-4 at concentrations above the groundwater standard during four of six sampling events. PCBs were also detected in New Plant deep monitoring well MW-8 at concentrations above the groundwater standard during two of four sampling events. The range of PCB concentrations were from non-detectable to 34 ppb (groundwater standard 0.09 ppb). Pesticides and PCBs were not detected in any off-site well.

Metals were detected in the total (unfiltered) metals samples from each on-site monitoring well at concentrations in excess of NYSDEC Class GA groundwater standards. These metals include antimony, barium, beryllium, chromium, copper, lead, mercury, nickel, selenium, thallium, and zinc. However, in the dissolved metals samples, only antimony, barium, chromium, nickel, selenium, thallium, and zinc were detected at concentrations greater than the groundwater standards. These exceedances were primarily in monitoring wells MW-1, MW-4, MW-5, and MW-8.

Maximum levels of antimony at 8.3 ppb in an unfiltered sample (groundwater standard of 3 ppb) and zinc at 2,500 ppb (groundwater standard of 300 ppb) were found in MW-1 on site. Maximum levels of selenium were in MW-3 at 26.8 ppb (groundwater standard of 10 ppb). Maximum levels of several unfiltered metals were found in MW-4: beryllium at 3 ppb (groundwater standard of 3 ppb), chromium at 576 ppb (groundwater standard of 50 ppb); copper at 1,580 ppb (groundwater standard of 200 ppb); lead at 178 ppb (groundwater standard of 25 ppb); mercury at 3.3 ppb (groundwater standard of 2 ppb); and nickel at 1,010 ppb (groundwater standard of 100 ppb). In MW-5 thallium was found at 9.2 ppb (groundwater standard of 4 ppb). Maximum levels of barium were found in MW-8 at 2,160 ppb (groundwater standard of 1,000 ppb).

Dissolved (filtered) metals were detected on site at these maximum concentrations: in MW-1 antimony at 18.3 ppb (groundwater standard of 3 ppb) and zinc at 2,200 ppb (groundwater standard of 300 ppb); in MW-4 chromium at 212 ppb (groundwater standard of 50 ppb), nickel at 623 ppb (groundwater standard of 100 ppb), and selenium at 14.3 ppb (groundwater standard of 10 ppb). In MW-5 thallium was detected at 7.6 ppb (groundwater standard of 4 ppb); and in MW-8 barium was detected at 2,000 ppb (groundwater standard of 1,000 ppb).

Antimony, lead, mercury, selenium, and zinc were detected in total metals samples in some off-site monitoring wells at concentrations in excess of NYSDEC Class GA groundwater standards. The exceedances were in monitoring well MW-7 and MW-9. However, in the dissolved metals samples, only antimony was detected at 5.1 ppb and in MW-9 it was detected at a concentration greater than the NYSDEC Class GA groundwater standard of 3 ppb.

The potential for non-aqueous liquids to be present at the site is difficult to predict without knowing the history of the ASTs and USTs including what compounds were stored in the tanks, what compounds were in the leaking USTs and what quantities were released. Historic information for the USTs indicated that in 1977, several tanks in the South Yard were found to be leaking and were replaced. However, there was no information on the chemicals stored in these South Yard tanks, the potential amount of discharge, or whether any cleanup was performed.

A UST at the site was found to be leaking fuel oil when it was removed in 1997. This tank was located approximately 40 feet northwest of MW-4. The details of the removal were reported in the OU1 RI Report. This tank is a known source of light non-aqueous-phase liquid (LNAPL).

During the installation and development of monitoring well MW-4 in 1997, LNAPL was not noted. During some sampling events an oily sheen and small oil globules were noted in the discharge water. During all four quarterly groundwater sampling events, the discharge water had a strong odor, was bluish-gray in color and produced foam in the discharge bucket.

During the installation of MW-8 in 1999, floating product was noted by the field inspector at 25 feet bgs. Small globules of free product were noted. During well development, non-aqueous-phase liquid (NAPL) was not noted in the discharge water. During groundwater sampling, NAPL was not noted in the discharge, however, there was a strong chemical odor, the water had a bluish gray color and produced foam in the discharge bucket.

Based on visual observations at monitoring wells, LNAPL is present in small quantities in the vicinity of monitoring wells MW-4 and MW-8. The horizontal extent of LNAPL contamination does not appear to extend beyond the area of these two wells.

Dense non-aqueous-phase liquids (DNAPL) were noted during the installation of MW-8 approximately 25 feet bgs during coring. The vertical extent appears to be limited to the upper 30 to 40 feet of the bedrock based on visual observations during drilling. The

lack of DNAPL present in well development and purge water would indicate that DNAPL is not present at or below the top of the well filter pack at 73 feet bgs. However, given the unpredictable nature of DNAPL movement through schist bedrock, its presence beyond MW-8 cannot be excluded. In MW-8 1,2-dichloroethane (1,2-DCA) was detected at moderately high concentrations (up to 14,000 ppb) in two of the groundwater monitoring events. While these concentrations are substantially lower than the theoretical solubility of 1,2-DCA (about 83,000 ppb), site records do indicate that this compound was stored in several on-site USTs; therefore, leaking USTs would have the potential for releases of free-phase 1,2-DCA and may account for the observed presence of DNAPL at this well. MW-4 also had moderately high concentrations of certain compounds that may form DNAPL: 1,2-dichloroethane at 110,000 ppb and perchloroethylene at 9,200 ppb.

Underground Storage Tanks

All USTs were removed as a part of the Interim Remedial Measures undertaken in 1997 and 1998.

1.4 SUMMARY OF REMEDIAL ACTIONS

The soils at the site were remediated in accordance with the NYSDEC-approved Remedial Action Work Plan, dated March, 2003 and the groundwater was remediated in accordance with the ROD for OU-2 dated July 2002.

The following is a summary of the Remedial Actions performed at the site:

1.4.1 OU-1 Soils

The OU-1 soils work was performed from June 2005 through December 29, 2005. Test pits and a Waste Acceptance Sampling Study were performed to obtain additional physical and chemical characterization data on the soil at the Site to be removed as part of the Remedial Action. The chemical characterization data was used to determine the waste classification of soil in various areas of the Site and to obtain approval from permitted off-site facilities for disposal of this material. The Site was divided into nine waste acceptance zones (WAZs), and the chemical data obtained from each WAZ was used to classify the soil to arrange for disposal. Boundaries of the WAZ areas were defined so as to encompass approximately equal quantities of soil (500 to 700 cubic yards).

Soil excavation began in October 2005 after the Site soils had been classified and disposal arrangements made. Soil in the northwest corner of the Site (WAZ-1) was excavated first. Excavation continued across each WAZ at the Site. WAZ-5 was the last area of the Site to be excavated. Soil was generally directly loaded onto trucks for transportation to off-site disposal facilities. In some cases soil was temporarily stockpiled on-site before transportation. Excavated soil was disposed of as either non-hazardous waste (landfill), hazardous waste (landfill), hazardous waste (incineration and landfill), or Toxic Substance and Control Act (TSCA) Hazardous Waste (Resource Conservation and Recovery Act Landfill).

After soil removal was complete, a survey was completed of the excavated bottom. In accordance with the ROD, the difference between the initial Site survey elevations and the excavated bottom elevations was at least 6 feet unless bedrock or groundwater was encountered. Excavated areas were filled with soil approved by NYSDEC after excavation was completed with a WAZ and the bottom of the excavation had been surveyed. Similarly, cover material (i.e., geotextile beneath a layer of crushed stone) was placed as excavated Site areas were filled.

For further details of the OU-1 remedial action see the *Hexagon Laboratories Site, Operable Unit 1 Soil Remedy, Final Construction Certification Report,* Day Engineering, PC and Cody Ehlers Group, May 2006.

1.4.2 OU-2 Groundwater

Bench-Scale Tests

Bench-scale treatability studies were completed focusing on groundwater contaminants of concern at the site. Two different contractors were used to complete the tests on three different oxidants with different dosages and/or additives. Both subcontractors conducted the tests using a water-soil (rock) composite matrix taken from the Site, in glass reaction vessels. The bench testing was completed over a two to three-week period. The effectiveness of the various oxidants was evaluated based on their ability to reduce the Site's groundwater contamination.

Regenesis evaluated two different oxidants: RegenOx and Fenton's. Based on the results of the bench-scale test, both RegenOx and Fenton's could be considered as a remedial approach, as both appeared to reduce site contamination. The modified RegenOx 3 showed the greatest contaminant reduction. Based on the elevated contaminant levels, a program that involved several injections was recommended.

ARS Technologies evaluated three different oxidants: 1) persulfate without activation; 2) persulfate with activation by chelated iron; and 3) persulfate with activation by base (NaOH). The persulfate with activation by NaOH showed the greatest overall contaminant reduction of site contamination, especially in regards to SVOCs. No significant increase of metals concentrations was observed, except for sodium and iron, which is likely the result from the additions of sodium hydroxide, sodium persulfate, and ferrous chloride. In conclusion, persulfate with activation by NaOH showed the greatest contaminant reduction. However, based on the elevated contaminant levels, a program that involves several injections would be necessary.

Considering the concentrated suite of contaminants present in the groundwater at the Hexagon site, the oxidants proposed and tested by each vendor performed reasonably well at the bench level with regard to the destruction of VOCs. The analytical results with regard to treatment of SVOCs show that sodium persulfate had a clear advantage in the reduction rate.

Based on cost comparisons it was determined that the application cost of sodium persulfate was approximately half the cost of applying RegenOx. Based on its cost and the ability of the non-activated sodium persulfate to be the most effective treatment for the site contamination, it was chosen as the ISCO for the Hexagon site.

Pilot Test Injection

ARS conducted a chemical injection pilot test at the Hexagon Laboratories Site in December 2009. The oxidants, sodium persulfate and 25% sodium hydroxide were used for the test. Based on site data gathered during the test, ARS made the following observations:

- Hydraulic connectivity was indicated by the presence of persulfate (>25 grams per liter [g/L]), and elevated pH, conductivity, oxidation reduction potential (ORP), and total dissolved solids (TDS) in monitoring wells MW-13 and MW-14 (both of which are 25 feet from IW-01); and
- There was limited to no hydraulic connection observed between injection well IW-01 and monitoring well MW-08 based on a review of the persulfate, pH, conductivity, oxygen reduction potential, and TDS levels in that well.

After a review of the site data gathered during the pilot test, groundwater analytical data, and ARS's remedial implementation report, EEEPC made the following observations:

- The hydraulic radius of influence (ROI) at IW-01 appears to be at least 25 feet in the directions of MW-13 and MW-14;
- A review of the pre-fracturing, post-fracturing, and post-injection groundwater sampling results identified the following trends:
  - After fracturing injection well IW-01 and injecting the oxidants, the concentration of some VOC and SVOC parameters in IW-01, MW-13, and MW-14 declined by several orders of magnitude. However, the concentrations of some VOC parameters in MW-14 increased by approximately 15%.
  - The VOC and SVOC concentrations in monitoring well MW-08 increased when compared to the pre-fracturing groundwater results.
  - Metal concentrations in all wells increased by comparing the pre- and post-chemical injection analytical data; and
- The pilot test performed by ARS in December 2009 was successful in verifying that chemical oxidation was effective at reducing VOC and SVOC mass in the dissolved phase.

Remedial Action

Three new open hole bedrock wells (MW-15, MW-16, and MW-17) were installed by Aztech Technologies, Inc. (Aztech) in December 2010 to further delineate the extent of contamination and facilitate remediation. In order to enlarge pathways in the bedrock to increase the transport rate of the chemical oxidants, two of the three new wells (MW-15 and MW-17) were hydraulically fractured by Harr Hydro Fracture, LLC (Harr), a subcontractor to Aztech. During the fracturing, water levels in adjacent boreholes (MW-14, MW-15, MW-16, and MW-17) were monitored to verify communication between the wells.

Following well development of the three new wells, a round of groundwater samples were collected from nine of the on-site wells (IW-01, MW-1, MW-5, MW-8, MW-13, MW-14, MW-15, MW-16, and MW-17) in January to March 2011 to develop a new baseline for groundwater remediation. While the groundwater data showed significant contaminant mass reduction in injection well IW-01, there were significant

contaminant concentration increases in adjacent wells MW-8, MW-13, and MW-14 after the pilot test injection. These contamination increases could be attributable to contaminant migration away from the injection well or the partitioning of the adsorbed phase mass from the bedrock into the dissolved phase.

In October 2011, approximately 4,400 gallons of chemical oxidants were injected into three wells at the site (MW-16, MW-17, and IW-01). The chemical oxidant mixture was a 20% (by weight solution) sodium persulfate (Klozur)/water mixture with a 25% (by weight solution) sodium hydroxide activator injected at 6 to 7 gallons per minute (GPM) in 5-foot long intervals. All nine wells were purged and sampled in December 2011, approximately two months after the injection, to determine the results of the chemical injection.

1.4.3 Site-Related Treatment Systems

No long-term treatment systems were installed as part of the site remedy.

1.4.4 Remaining Contamination

Soils

After the soils remediation, all source soils were removed to bedrock in the northern and southern portion of the site and only in the eastern portion were soils left on the site. The soils in the eastern portion that were left on-site were left because they were either more than 6 feet below ground surface or they were below the groundwater level. Due to the nature of the soils removal program (i.e., to a prescribed depth-related termination point rather than a cleanup level) there was no need for post remediation samples. The only indication of the soil contamination left after the OU-1 remedial effort is to look at the samples from the eastern portion of the site that were taken at a depth greater than 6 feet prior to the remedial effort. These samples are listed in Tables 1-1 through 1-5 and their locations are provided in Figure 1-4.

Groundwater

Based on various rounds of groundwater sampling performed at the site, VOC, SVOC, and metals contamination are present at the site, although VOCs are the primary contamination present in the bedrock groundwater. Thirty-one different VOCs have been detected in the groundwater samples at the site, but the following nine target compounds comprise the majority of the VOC contamination at the site: 1,2-dichloroethane; acetone;

benzene; chlorobenzene; cis-1,2-dichloroethene (cis-1,2-DCE); tetrachloroethene (PCE); trichloroethene (TCE); toluene; and vinyl chloride. Twenty different SVOCs have been detected in the groundwater samples at the site, with 2-methylphenol and 4-methylphenol comprising the majority of SVOC contamination at the site. Twenty-four different metals (including mercury and cyanide) have been detected in the groundwater at the site. The six most common metals (by concentration) are: calcium, iron, magnesium, manganese, potassium, and sodium.

The latest round of off-site groundwater samples were collected in February 2009 during the bench-scale portion of this investigation (see Table 1-6). The total concentration of the nine target VOCs detected off-site ranges from non-detect in MW-6 and MW-7 to 623 µg/L in MW-02. The total concentration of 2-methylphenol and 4-methylphenol contamination off-site ranges from non-detect in MW-02, MW-6, and MW7 to 3.2 µg/L in MW-11. The total concentration of the six most common metals detected off-site ranges from 180 mg/L in MW-06 to 359 mg/L in MW-11.

The latest round of on-site groundwater samples were collected from seven monitoring wells (IW-01, MW-8, MW-13, MW-14, MW-15, MW-16, and MW-17) in December 2011, approximately 2 months after the last chemical injection performed at the site (see Table 1-7). The total concentration of the nine target VOCs detected on-site ranges from 16,280 µg/L in MW-16 to 790,030 µg/L in MW-08. The total concentration of 2-methylphenol and 4-methylphenol contamination on- site ranges from non-detect in MW-16 to 59,600 µg/L in MW-08. The total concentration of the six most common metals detected at the site ranges from 1,229 mg/L in MW-08 to 5,172 mg/L in MW-13.

For further analysis of this data, see the *Hexagon Final Engineering Report for Operable Unit 2,* EEEPC, May 2012.

2.0 ENGINEERING AND INSTITUTIONAL CONTROL PLAN

2.1 INTRODUCTION

2.1.1 General

Since remaining contaminated soil and groundwater exists beneath the site, EC/ICs are required to protect human health and the environment. This Engineering and Institutional Control Plan describes the procedures for the implementation and management of all EC/ICs at the site. The EC/IC Plan is one component of the SMP and is subject to revision by NYSDEC.

2.1.2 Purpose

This plan provides:

- A description of all EC/ICs on the site;
- The basic implementation and intended role of each EC/IC;
- A description of the key components of the ICs set forth in the Environmental Deed Restriction;
- A description of the features to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of EC/ICs, such as the implementation of the Excavation Work Plan for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the EC/ICs required by the site remedy, as determined by NYSDEC.

2.2 ENGINEERING CONTROLS

2.2.1 Engineering Control Systems

2.2.1.1 Soil Cover

Exposure to remaining contamination in soil/fill at the site is prevented by a soil cover system placed over the site. This cover system is comprised of a minimum of 24 inches of clean soil, geotextile fabric layer, and 6 inches of crushed bluestone (gravel). The Excavation Work Plan that appears in Appendix A outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection and maintenance of this cover are provided in the Monitoring Plan included in Section 4 of this SMP.

2.2.1.2 Locked Monitoring Well Cover System

Exposure to remaining contamination in groundwater via the site monitoring wells is prevented by a well cover system. This cover system is comprised of a locked seal at the top of the well casing (locked j-plug) and bolted flush-mounted cover over the well. The Groundwater Monitoring Well Maintenance Plan in Appendix B outlines the procedures required to be implemented in the event the well cover system is destroyed, removed or compromised in any manner. Procedures for the inspection and sampling of the monitoring wells are provided in the Monitoring Plan included in Section 4 of this SMP.

2.2.1.3 Access Control

The entire site is enclosed in chain-link fence topped with barbed wire. The access gates in the fence are locked. Keys to the locks are in the possession of NYSDEC. The site access shall remain controlled while the site is not in use and if, in the future, the site is put to use, access shall be limited to the use and users intended.

2.2.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document or in the case of the ROD for OU-2, when NYSDEC

determines that it is impracticable to continue. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

2.2.2.1 Soil Cover System

The soil cover system is a semi-permanent control and the quality and integrity of this system or a system installed to replace it will be inspected at defined, regular intervals in perpetuity. As covered in the Institutional Controls Section, this soil cover system is not to be disturbed unless a design is submitted and approved by NYSDEC that will continue to prevent exposure to contamination remaining in the soils on this site. Such design may have to include a soil vapor mitigation system in order to obtain approval. This institutional control is also in place because NYSDEC recognizes the potential for cover soils to become contaminated from leaching of contaminates from the fissures of the underlying bedrock due to fluctuations in the groundwater table.

2.2.2.2 Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will continue, as determined by the NYSDEC, until residual groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

2.3 INSTITUTIONAL CONTROLS

A series of Institutional Controls is required by the ROD to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the site to restricted commercial uses only. Adherence to these Institutional Controls on the site is required by the Environmental Deed Restrictions and will be implemented under this Site Management Plan. These Institutional Controls are:

- Compliance with the Environmental Deed Restriction and this SMP by the Grantor and the Grantor's successors and assigns;
- All Engineering Controls must be operated and maintained as specified in this SMP;
- All Engineering Controls on the Controlled Property must be inspected at a frequency and in a manner defined in the SMP;
- Groundwater, soil, and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in this SMP.

Institutional Controls identified in the Environmental Deed Restriction may not be discontinued without an amendment to or extinguishment of the Environmental Notice.

The site has a series of Institutional Controls in the form of site restrictions. Adherence to these Institutional Controls is required by the Environmental Deed Restriction. Site restrictions that apply to the Controlled Property are:

- The property may only be used for restricted commercial use provided that the long-term Engineering and Institutional Controls included in this SMP are employed;
- The property may not be used for a higher level of use, such as unrestricted commercial use without additional remediation and amendment of the Environmental Deed Restrictions, as approved by the NYSDEC;
- All future activities on the property that will disturb the soil cover system or remaining contaminated 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;
- Vegetable gardens and farming on the property are prohibited;
- The site owner or remedial party will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls

employed at the Controlled Property 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 constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

2.3.1 Excavation Work Plan

The site has been remediated for restricted commercial use. Any future intrusive work that will penetrate the soil cover system by more than 30 inches, or encounter or disturb the remaining contamination, including any modifications or repairs to the existing cover system will be performed in compliance with the Excavation Work Plan (EWP) that is attached as Appendix A 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. A sample HASP is attached as Appendix C to this SMP that is in current compliance with DER-10, and 29 CFR 1910, 29 CFR 1926, and all other applicable Federal, State and local regulations. The CAMP shall be prepared in accordance with the current NYSDEC guidance for such plans. Based on future changes to state and federal health and safety requirements, and specific methods employed by future contractors, the HASP and CAMP will be updated and re-submitted with the notification provided in Section A-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the periodic inspection and certification reports submitted under the Site Management Reporting Plan (see Section 5).

The site owner and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all intrusive work, the structural integrity of excavations, proper disposal of excavation de-water, control of runoff from open excavations into remaining contamination, and for structures that may be affected by excavations (such as building foundations and bridge footings). The site owner will ensure that site development

activities will not interfere with, or otherwise impair or compromise, the engineering controls described in this SMP.

2.4 INSPECTIONS AND NOTIFICATIONS

2.4.1 Inspections

Inspections of all remedial components installed at the site will be conducted at the frequency specified in the SMP Monitoring Plan schedule. A comprehensive site-wide inspection will be conducted annually, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether Engineering Controls continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Deed Restrictions;
- Achievement of remedial performance criteria;
- Sampling and analysis of appropriate media during monitoring events;
- If site records are complete and up to date; and
- Changes, or needed changes, to the remedial or monitoring system;

Inspections will be conducted in accordance with the procedures set forth in the Monitoring Plan of this SMP (Section 3). The reporting requirements are outlined in the Periodic Review Reporting section of this plan (Section 5).

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 effectiveness of the EC/ICs implemented at the site by a qualified environmental professional as determined by NYSDEC.

2.4.2 Notifications

Notifications will be submitted by the property owner to NYSDEC as needed for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the Order on Consent, 6 NYCRR Part 375, and/or Environmental Conservation Law.
- 7-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 the monitoring wells that reduces or has the potential to reduce the effectiveness of other Engineering Controls and likewise any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire, flood, or earthquake that reduces or has the potential to reduce the effectiveness of Engineering Controls in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action shall be submitted to 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, 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 Order on Consent, 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

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. Prompt contact should also be made to Mr. Michael Mason, P.E. of NYSDEC. This emergency contact list must be maintained in an easily accessible location at the site.

Table 2-1: Emergency Contact Numbers

Medical, Fire, and Police:	911
One Call Center:	(800) 272-4480 (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
Mr. Michael Mason, P.E. (NYSDEC)	(518) 402-9814

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

2.5.2 Map and Directions to Nearest Health Facility

Site Location: 3536 Pear Tree Avenue, Bronx, New York 10475

Nearest Hospital Name: North Central Bronx Hospital

Hospital Location: 3424 Kossuth Avenue, Bronx, New York 10467-2410,

Hospital Telephone: 718-519-5000

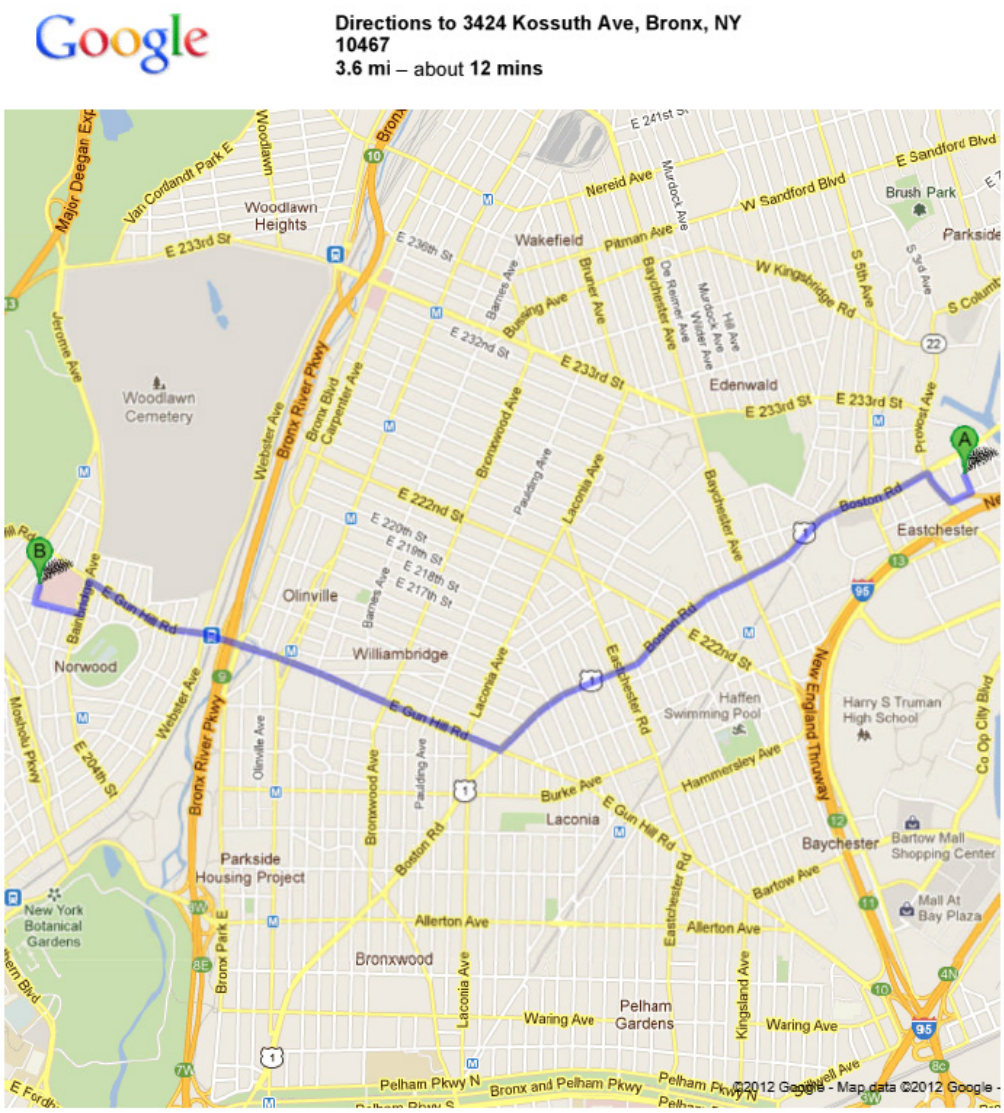
Directions to the Hospital:

1. Go south on Pear Tree Avenue for 315 feet, turn right onto Hollers Avenue. Go west on Hollers Avenue for 394 feet, turn right onto Conner Street. Go north on Conner Street for 0.1 miles, turn left onto US-1 (Boston Road). Go west on US-1 1.6

miles, turn right onto E. Gun Hill Road. Go north on E. Gun Hill Road for 1.4 miles, turn left onto Bainbridge Avenue. Go west on Bainbridge Avenue for 0.1 miles, turn right onto E 210th Street. Go north on E 210th Street for 0.1 miles, turn right onto Kossuth Avenue. Go east on Kossuth Avenue for 269 feet you are at 3424 Kossuth Avenue. Total Distance: 3.6 miles

Total Estimated Time: 12 to 20 minutes, depending on traffic

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). The list will also be posted prominently at the site and made readily available to all personnel at all times.

Spill control procedures: Mark the area as off limits until monitoring indicates that volatile hazards are not present. Collect contaminated material and place in waste drums. Replace the removed soil in-kind and replace the geotextile layer and the covering stone layer. If the spill was on personnel and is life threatening, then gross material removal and personal protective equipment (PPE) removal only, then transport to hospital.

Evacuation plans: Set up a signal for evacuation prior to conducting well sampling work and choose a method that will be audible and perceptible above ambient noise and light levels. Such a method may be a 15-second or more sounding of a hand-held air horn or vehicle horn. Establish an assembly point upwind of the site and secure the site to access when evacuating.

Amendments to this contingency plan must be in writing and be reviewed and approved by a certified hygienist before they are submitted to NYSDEC for approval.

3.0 SITE MONITORING PLAN

3.1 INTRODUCTION

3.1.1 General

The Monitoring Plan describes the measures for evaluating the performance and effectiveness of the remedy to reduce or mitigate contamination at the site, the soil cover system, and all affected site media identified below. This Monitoring Plan may only be revised with the approval of NYSDEC.

3.1.2 Purpose and Schedule

This Monitoring Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater and soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly ambient groundwater standards and Part 375 SCOs for soil;
- Assessing achievement of the remedial performance criteria.
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment; and
- Preparing the necessary reports for the various monitoring activities.

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

- 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; and
- Annual inspection and periodic certification.

Annual monitoring of the performance of the remedy and overall reduction in contamination on-site and off-site will be conducted for the first five years. The frequency thereafter will be determined by NYSDEC. Trends in contaminant levels in soil, and groundwater in the affected areas, will be evaluated to determine if the remedy continues to be effective in achieving remedial goals. Monitoring programs are summarized in Table 3-1 and outlined in detail in Sections 3.2 and 3.3.

3.2 SOIL COVER SYSTEM MONITORING

The soil cover system shall be inspected at least annually and any time an activity at the site may disturb or alter the soil cover system intentionally or unintentionally. The thickness of blue stone cover shall be checked for relative consistency of 6 inches thickness throughout the site. At least four separate locations shall be checked scattered throughout the site (approximately 1 location per 100-foot by 100-foot area). When checking the thickness of the gravel cover it shall be verified that the geotextile barrier is in place below the gravel. The fill soil beneath the geotextile barrier shall be profiled and sampled from two of the four locations to determine if the fill material has become contaminated due to fluctuations in the perched groundwater table. Continuous soil cores will be collected from the top of the fill material until bedrock or native soil is reached (approximately 5 to 6 feet bgs) using macro-core, split-spoon, or hand auger methods. A total of three soil samples from each boring will be submitted for laboratory analysis: the fill material from within 1 foot below the geotextile barrier; the fill material from within 1 foot of bedrock or native soil; and the fill material from the approximate middle of the column. Upon completion, boreholes will be backfilled with sand to within 0.3 feet of the geotextile barrier, then 0.5 feet of bentonite chips across the barrier interface (approximately 0.25 feet above and 0.25 feet below), followed by gravel (blue stone) cover to ground surface.

3.3 MEDIA MONITORING PROGRAM

Based on the lack of structures and facilities currently present at the Hexagon Site, groundwater is the only media that needs to be monitored under the site management plan. However, if buildings or other structures are constructed at the site in

the future, additional media (such as indoor air) may need to be addressed. The outline for groundwater monitoring is provided below. Procedures for monitoring additional media in the future should be described in similar detail as necessary.

3.3.1 Groundwater Monitoring

Although the majority of the monitoring wells installed during the remedial investigation and remedial action phases of the project have been decommissioned, four monitoring wells remain at the site to monitor both up-gradient and down-gradient groundwater conditions at the site (see the site map in Appendix C). The well network includes two on-site bedrock wells (MW-15 and MW-2) and two off-site overburden wells (MW-6 and MW-11).

Monitoring well MW-15 is located in the primary source area of the bedrock contamination, while MW-02 is located at the down-gradient end of the site to verify bedrock groundwater contamination is not leaving the site. Both bedrock monitoring wells are constructed as 4-inch diameter open-hole wells, with the protective steel casing set approximately 5 feet into rock so each well monitors groundwater fractures from 10 to 50 feet bgs (see monitoring well construction logs in Appendix E). The latest sample results for MW-15 (December 2011) shows some contamination remains trapped in the bedrock at the site (505,800 µg/L of the target VOCs, 13,300 µg/L of 2-/4-methylphenol contamination, and 2,371 mg/L total concentration of the six most common metals), but these results show a 34% reduction in target VOCs, a 43% reduction of 2-/4-methylphenol, and a 86% increase in the six common metals after the October 2011 chemical oxidant injection. The latest sample results for MW-02 (February 2009) showed little to no contamination was migrating off-site with 623 µg/L of the target VOCs, no 2-/4-methylphenol contamination, and 233 mg/L total concentration of the six most common metals detected at the site.

Overburden monitoring well MW-6 is located up-gradient of the site, while MW-11 is located approximately 200 feet down-gradient of the site. The purpose of these wells is to track any potential overburden groundwater contamination entering/leaving the site and verify that shallow groundwater contamination is not present to pose a threat to the public or local businesses. Both flush-mounted overburden wells are constructed with a 10-foot-long, 2-inch inner diameter (ID) PVC screen with a 0.010-inch slot size flush-thread connected to 2-inch ID Schedule 40 PVC riser to approximately 6 inches below grade. The sand packs extend from the bottom of the screen to approximately 2 feet above the screen, followed by a 2-foot bentonite seal and then bentonite/cement

grout to 1 foot bgs. The latest sample results for MW-6 show no target VOCs or 2-/4-methylphenol contamination and 180 mg/L total concentration of the six most common metals are migrating onto the site. The latest sample results for MW-11 show 39 µg/L of the target VOCs, 3.2 µg/L of 4-methylphenol contamination, and 359 µg/L total concentration of the six most common metals in the overburden down-gradient of the site.

Groundwater monitoring will be performed on an annual basis to assess the performance of the remedy.

The sampling frequency may be modified with the approval of NYSDEC. The SMP will be modified to reflect changes in sampling plans approved by NYSDEC.

3.3.1.1 Sampling Protocol

For a detailed description of field activities and procedures, see the Field Sampling Plan in Appendix G.

All field activities are expected to be conducted by personnel wearing Level D PPE. However, field team members will maintain Level C respiratory protection equipment on site for use should the need arise.

All monitoring well gauging and sampling activities will be recorded in a field book or on appropriate field forms (presented in Appendix I). Other observations (e.g., well integrity) will be noted on the well sampling log, which will also serve as the inspection form for the groundwater monitoring well network (presented in Appendix F).

3.3.1.2 Monitoring Well Repairs, Replacement, and Decommissioning

During the monitoring well sampling activities, all site monitoring wells will be inspected for structural integrity and overall performance. Any identified monitoring well issues will be identified in the field book or forms, and NYSDEC will be notified prior to repairs.

If biofouling or silt accumulation occurs in the site monitoring wells, the wells will be physically agitated/surged and redeveloped. Details about the redevelopment process are provided in the Field Sampling Plan in Appendix G.

NYSDEC will be notified prior to any repair or decommissioning and/or replacement of monitoring well at the Site. NYSDEC must be provided with a work plan and their approval must be obtained prior to performance of any work. Well abandonment must be performed in accordance with NYSDEC's "Groundwater

Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. A fieldwork summary report will be provided to NYSDEC once all well decommissioning and/or replacement work is completed.

3.4 SITE-WIDE INSPECTION

Site-wide inspections will be performed on a regular schedule at a minimum of once a year. Site-wide inspections will also be performed after all severe weather conditions that may affect Engineering Controls or monitoring devices. During these inspections, an inspection form will be completed (Appendix I). 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; and
- Confirm that site records are up to date.

3.5 MONITORING QUALITY ASSURANCE/QUALITY CONTROL

All sampling and analyses will be performed in accordance with the requirements of the generic Quality Assurance Project Plan (QAPP) prepared for the site (Appendix H). Main Components of the QAPP include:

- QA/QC Objectives and Criteria;
- Data Generation and Acquisition
    - Sample process design,
    - Sampling methods,
    - Sample handling and custody,
    - Analytical method requirements,

- Quality control,
- Instrument/Equipment testing, inspection, and maintenance,
- Instrument/Equipment calibration and frequency,
- Inspection/Acceptance of supplies and consumables,
- Non-direct measurements, and
- Data management;

- Assessment and Oversight
  - Assessment and response actions, and
  - Reports to management; and
- Data Validation and Usability
  - Data review, validation, and verification requirements,
  - Validation and verification methods, and
  - Reconciliation with user requirements.

3.6 MONITORING REPORTING REQUIREMENTS

Annual reports shall be prepared and submitted to NYSDEC that provide details regarding field activities, sampling and analysis results, waste handling, and any monitoring well repairs performed. Other activities, such as well abandonment, will be submitted to NYSDEC as a separate report. At a minimum, the annual report will include:

- Date of event;
- Personnel conducting sampling;
- Description of the activities performed;
- Type of samples collected (e.g., soil and groundwater);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation);
- Sampling results in comparison to appropriate standards/criteria;

- A figure illustrating sampling locations;
- A figure illustrating groundwater elevation measurements and estimated direction of flow;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether groundwater conditions have changed since the last reporting event.

Field forms and any other information generated during annual monitoring events will be kept on file in a secure location. 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 Periodic Review Report, as specified in the Reporting Plan of this SMP. Data will be reported in hard copy or digital format as determined by NYSDEC. A summary of the monitoring program deliverables is provided in Table 3-2.

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.

5.0 INSPECTIONS, REPORTING AND CERTIFICATIONS

5.1 SITE INSPECTIONS

5.1.1 Inspection Frequency

All inspections will be conducted at the frequency specified in the schedule provided in Section 3 Monitoring Plan of this SMP. At a minimum, a site-wide inspection and sampling will be conducted annually. Inspections of remedial components will also be conducted whenever a severe condition has taken place, such as a flooding event or construction activities, which may affect the ECs.

5.1.2 Inspection Forms, Sampling Data, and Maintenance Reports

All inspections and monitoring events will be recorded on the appropriate forms for their respective system which are contained in Appendix F. Additionally, a general site-wide inspection form will be completed during the site-wide inspection (see Appendix I). These forms are subject to NYSDEC revision.

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

5.1.3 Evaluation of Records and Reporting

The results of the inspection and site monitoring data will be evaluated as part of the EC/IC certification to confirm that the:

- EC/ICs are in place, are performing properly, and remain effective;
- The Monitoring Plan is being implemented; and
- The site remedy continues to be protective of public health and the environment and is performing as designed in the Remedial Action Work Plan.

5.2 CERTIFICATION OF ENGINEERING AND INSTITUTIONAL CONTROLS

After the last inspection of the reporting period, a qualified environmental professional will prepare the following certification:

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

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

Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as Owner's Designated Site Representative (for the site.

The signed certification will be included in the Periodic Review Report described below.

- No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid; and

Every five years the following certification will be added:

- The assumptions made in the qualitative exposure assessment remain valid.

The signed certification will be included in the Periodic Review Report described below.

5.3 PERIODIC REVIEW REPORT

A Periodic 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, No Further Action Letter) is issued. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix C (Site Map). 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 Periodic 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;

- A summary of any discharge monitoring data and/or information generated during the reporting period with comments and conclusions;
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil), 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:
    - The compliance of the remedy with the requirements of the site-specific ROD;
    - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring Plan for the media being monitored;
    - Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan; and
    - The overall performance and effectiveness of the remedy.

The Periodic 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 New York State Department of Health, Bureau of Environmental Exposure Investigation.

5.4 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 institutional or engineering control, 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 NYSDEC.

TABLES

Table 1-1 East Yard Samples Deeper than 6 feet BGS,
Volatile Organic Compounds

Sample Location	EAST YARD	
Field Sample ID	HXB1S7	HXB7S4
Sample Interval (feet bgs)	11 - 13	6 - 8
Date Sampled	11/19/1997	11/11/1997
Aromatics		
Benzene	11 U	1 J
Toluene	11 U	78 J
Ethylbenzene	11 U	2 J
Xylene(total)	11 U	12 J
Styrene	11 U	11 UJ
Halogenated Aliphatics		
Chloromethane	11 U	11 UJ
Bromomethane	11 UJ	11 UJ
Vinyl Chloride	11 U	11 UJ
Chloroethane	11 U	11 UJ
Methylene Chloride	6 J	1 J
1,1-Dichloroethene	11 U	11 UJ
1,1-Dichloroethane	11 U	11 UJ
1,2-Dichloroethene (total)	11 U	11 UJ
Chloroform	11 U	11 UJ
1,2-Dichloroethane	24	34 J
1,1,1-Trichloroethane	11 U	1 J
1,2-Dichloropropane	11 U	11 UJ
Trichloroethene	0.9 J	9 J
Tetrachloroethene	11 U	5 J
Ketones		
Acetone	30	30 J
2-Butanone	3 J	5 J
4-Methyl-2-pentanone	11 U	11 UJ
2-Hexanone	11 U	11 UJ
Other/Miscellaneous VOCs		
Carbon disulfide	11 U	11 UJ
Chlorobenzene	3 J	2 J
TOTAL TARGET VOCs	67 J	180 J
Number of VOA TICs	2	0
Total VOA TIC Concentration	44 J	

Notes:

1. Recommended soil cleanup levels obtained from the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046.

2. As per TAGM #4046, Total VOCs must be less than 10 ppm (10,000 ug/kg).

3. Recommended soil cleanup level corresponds to trans 1,2-dichloroethene.

4. U = Not detected; J = Estimated value; R = Rejected value; N = Presumptive evidence of presence; D = Diluted sample; NC = No criterion.

5. Shading indicates exceedance of NYSDEC TAGM Levels.

6. B1 is MW-1 on the sample location figure

Table 1-2 East Yard Samples Deeper than 6 feet BGS, Semivolatile Organic Compounds

Sample Location	EAST YARD	
Field Sample ID	HXB1S7	HXB7S4
Sample Interval (feet bgs)	11 - 13	6 - 8
Date Sampled	11/19/1997	11/11/1997
Phenols/Acid Extractables		
Phenol	530 UJ	380 U
2-Chlorophenol	530 UJ	380 U
2-Methylphenol (o-cresol)	530 UJ	380 U
4- Methylphenol	530 UJ	380 U
2,4-Dimethylphenol	530 UJ	380 U
Pentachlorophenol	1300 UJ	960 U
Polycyclic Aromatic Hydrocarbons (PAHs)		
Naphthalene	530 UJ	380 U
2-Methylnaphthalene	530 UJ	380 U
Acenaphthylene	530 UJ	380 U
Acenaphthene	530 UJ	380 U
Fluorene	530 UJ	380 U
Phenanthrene	530 UJ	380 U
Anthracene	530 UJ	380 U
Fluoranthene	530 UJ	380 U
Pyrene	530 UJ	380 U
Benzo(a)anthracene	530 UJ	380 U
Chrysene	530 UJ	380 U
Benzo(b)fluoranthene	530 UJ	380 U
Benzo(k)fluoranthene	530 UJ	380 U
Benzo(a)pyrene	530 UJ	380 U
Indeno(1,2,3-cd)pyrene	530 UJ	380 U
Dibenz(a,h)anthracene	530 UJ	380 U
Benzo(g,h,i)perylene	530 UJ	380 U
Aniline Compounds		
4-Chloroaniline	530 UJ	380 U
4-Nitroaniline	1300 UJ	960 U
Benzenes/Aromatics		
1,3-Dichlorobenzene	530 UJ	380 U
1,4-Dichlorobenzene	530 UJ	380 U
1,2-Dichlorobenzene	530 UJ	380 U
Phthalates		
Dimethylphthalate	530 UJ	380 U
Diethylphthalate	530 UJ	380 U
Di-n-butyl phthalate	530 UJ	380 U
Butylbenzyl phthalate	530 UJ	380 U
bis(2-Ethylhexyl)phthalate	64 J	380 U
Di-n-octyl phthalate	530 UJ	380 U

Table 1-2 East Yard Samples Deeper than 6 feet BGS, Semivolatile Organic Compounds

Sample Location	EAST YARD	
Field Sample ID	HXB1S7	HXB7S4
Sample Interval (feet bgs)	11 - 13	6 - 8
Date Sampled	11/19/1997	11/11/1997
Other/Miscellaneous SVOCs		
Carbazole	530 UJ	380 U
Dibenzofuran	530 UJ	380 U
Total Target SVOCs	64 J	0 J
Number of SVOA TICs	4	0
Total SVOA TIC Concentration	2,030 J	

Notes:

1. Recommended soil cleanup levels obtained from the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046.

2. As per TAGM #4046, Total SVOCs must be less than 500 ppm (500,000 ug/kg).

3. U = Not detected; J = Estimated value; R = Rejected value; N = Presumptive evidence of presence; D = Diluted sample; NC = No criterion.

4. Shading indicates exceedance of NYSDEC TAGM Levels.

Table 1-3 East Yard Samples Deeper than 6 feet BGS, Pesticides and Polychlorinated Biphenyls

Sample Location	EAST YARD	
Field Sample ID	HXB1S7	HXB7S4
Sample Interval (feet bgs)	11 - 13	6 - 8
Date Sampled	11/19/1997	11/11/1997
Pesticides		
alpha-BHC	0.54 U	2.0 U
beta-BHC	0.54 U	2.0 U
delta-BHC	0.54 U	2.0 U
gamma-BHC (Lindane)	0.54 U	2.0 U
Heptachlor	0.54 U	2.0 U
Aldrin	0.54 U	2.0 U
Heptachlor Epoxide	0.54 U	2.0 U
Endosulfan I	0.54 U	2.0 U
Dieldrin	1.0 U	3.8 U
4,4'-DDE	1.0 U	3.8 U
Endrin	1.0 U	3.8 U
Endosulfan II	1.0 U	3.8 U
4,4'-DDD	1.0 U	3.8 U
Endosulfan Sulfate	1.0 U	3.8 U
4,4'-DDT	1.0 U	3.8 U
Methoxychlor	5.4 U	20 U
Endrin ketone	1.0 U	3.8 U
Endrin aldehyde	1.0 U	3.8 U
alpha-Chlordane	0.54 U	2.0 U
gamma-Chlordane	0.54 U	2.0 U
PCBs		
Aroclor-1242	10 U	38 U
Aroclor-1248	10 U	38 U
Aroclor-1254	10 U	38 U
Aroclor-1260	10 U	38 U

Notes:

1. Recommended soil cleanup levels obtained from the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046.

2. As per TAGM #4046, total pesticide concentration shall be less than 10 ppm (10,000 ug/kg).

3. Soil cleanup objective for Chlordane does not specify isomer.

4. Recommended soil cleanup level corresponds to total PCBs in subsurface soil.

5. U = Not detected; J = Estimated value; R = Rejected value; N = Presumptive evidence of presence; D = Diluted sample; NC = No criterion; NA = Not analyzed.

6. Shading indicates exceedance of NYSDEC TAGM Levels.

Table 1-4 East Yard Samples Deeper than 6 feet BGS, Metals

Sample Location	EAST YARD	
Field Sample ID	HXB1S7	HXB7S4
Sample Interval (feet bgs)	11 - 13	6 - 8
Date Sampled	11/19/1997	11/11/1997
Aluminum	16900	13600
Antimony	0.55 U	0.58 U
Arsenic	3.4	2.7
Barium	152	133
Beryllium	0.74	0.47
Cadmium	0.11 U	0.31
Calcium	1600	1450
Chromium	78.3	56.4
Cobalt	14.4	12.5
Copper	52.1 J	35.6
Iron	26700	23600
Lead	8.2 J	41.6
Magnesium	8230	6750
Manganese	266	180 J
Mercury	0.04	0.03 U
Nickel	64.6	44.6
Potassium	8320 J	7720
Selenium	0.91 U	0.97 U
Silver	0.36 UJ	0.39 UJ
Sodium	415	127
Thallium	1.1	0.39 U
Vanadium	48.1	40.4
Zinc	124	116 J
Cyanide	1.0 U	0.64 U

Notes:

1. Recommended soil cleanup levels obtained from the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046.

2. Except as noted, background concentrations represent the maximum background concentration for New York State soils as reported by E.C. McGovern, NYSDEC, in "Background Concentrations of 20 Elements in Soils with Special Regard for New York State", undated.

3. Maximum concentration listed for urban New Jersey soils as reported by NJDEPE in "A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey", 1993.

4. Maximum concentration detected in site-specific background sample.

5. As indicated in NYSDEC TAGM HWR-94-4046, average background levels of lead in metropolitan or suburban areas or near highways typically range as high as 500 ppm.

6. Background concentrations for cyanide were not reported in literature sources reviewed. Cyanide was not detected in the three site-specific background samples and, therefore, the background concentration for cyanide is assumed to be non detect.

7. U = Not detected; J = Estimated value; R = Rejected value; BKGD = Site background concentration; NC = No criterion; ND = Non detect.

8. Shading indicates exceedance of NYSDEC TAGM Levels.

Table 1-5 East Yard Samples Deeper than 6 feet BGS, Total Organic Compounds and Total Petroleum Hydrocarbons

Sample Location	EAST YARD
Field Sample ID	HXB1S7
Sample Interval (feet bgs)	11 - 13
Date Sampled	11/19/1997
TOC	519
TPHC	NA

Notes:

1. NA = Not analyzed.

Table 1-6 Summary of Latest Analytical Results for Off-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: / Date: / Screening Criteria [1]	MW-02 21209 02/12/09	MW-06 21209 02/12/09	MW-07 21209 02/12/09	MW-11 21109 02/11/09
Mertals by Method SW6010B (mg/L)					
ALUMINUM	NA	**0.31**	**4.59**	**12.4**	**30.4**
ANTIMONY	0.003	0.02 U	0.02 U	0.02 U	0.02 U
ARSENIC	0.025	0.010 U	0.010 U	0.010 U	0.010 U
BARIUM	1	**0.122**	**0.197**	**0.431**	**0.278**
BERYLLIUM	0.003	0.02 U	0.02 U	0.02 U	0.02 U
CADMIUM	0.005	0.0002 U	0.0002 U	0.0002 U	0.0002 U
CALCIUM*	NA	**30.5**	**68.5**	**143**	**64.4**
CHROMIUM, TOTAL	0.05	0.010 U	**0.087**	**0.031**	**0.082**
COBALT	NA	0.050 U	**0.144**	0.050 U	0.050 U
COPPER	0.2	0.0100 U	**0.109**	**0.0312**	**0.164**
IRON*	0.3	**10.7**	**13.4**	**14.3**	**63.5**
LEAD	0.025	0.0150 U	**0.0455**	0.0150 U	**0.0317**
MAGNESIUM*	35	**16.3**	**16.3**	**27.2**	**36.6**
MANGANESE*	0.3	**1.14**	**5.63**	**3.72**	**2.12**
NICKEL	0.1	0.010 U	**0.041**	**0.042**	**0.052**
POTASSIUM*	NA	**29.3**	**20.7**	**12.8**	**86.1**
SELENIUM	0.01	0.015 U	0.015 U	0.015 U	0.015 U
SODIUM*	20	**145**	**55.3**	**140**	**106**
VANADIUM	NA	0.050 U	0.050 U	0.050 U	**0.082**
ZINC	2	**0.034**	**0.243**	**0.330**	**0.235**
TOTAL 6 COMMON METALS	NA	**233**	**180**	**341**	**359**
Mercury by Method SW7470A (mg/L)					
MERCURY	0.0007	0.00010 U	**0.0152**	0.00070	0.00015

Table 1-6 Summary of Latest Analytical Results for Off-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: Date: Screening Criteria [1]	MW-02 21209 02/12/09	MW-06 21209 02/12/09	MW-07 21209 02/12/09	MW-11 21109 02/11/09
VOCs by Method SW8260B (µg/L)					
1,1,1-TRICHLOROETHANE	5	10.0 U	1.0 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	5	10.0 U	1.0 U	1.0 U	**1.8**
1,1-DICHLOROETHENE	5	10.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROBENZENE	3	10.5	1.0 U	1.0 U	**1.8**
1,2-DICHLOROETHANE*	0.6	10.0 U	1.0 U	1.0 U	1.0 U
ACETONE*	50	500 UJ	50.0 U	50.0 U	50.0 U
BENZENE*	1	**168**	1.0 U	1.0 U	**1.8**
BROMOMETHANE	5	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROBENZENE*	5	**455**	1.0 U	1.0 U	**36.8**
CHLOROFORM	7	20.0 U	2.0 U	2.0 U	2.0 U
CHLOROMETHANE	5	1.0 U	1.0 U	1.0 U	1.0 U
CIS-1,2-DICHLOROETHYLENE*	5	10.0 U	1.0 U	1.0 U	1.0 U
CYCLOHEXANE	NA	10.0 U	10.0 U	10.0 U	10.0 U
ETHYLBENZENE	5	10.0 U	1.0 U	1.0 U	1.0 U
METHYL ETHYL KETONE (2-BUTANONE)	50	10.0 U	10.0 U	10.0 U	10.0 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	NA	10.0 U	10.0 U	10.0 U	10.0 U
METHYLCYCLOHEXANE	NA	10.0 U	10.0 U	10.0 U	10.0 U
METHYLENE CHLORIDE	5	50.0 U	5.0 U	5.0 U	5.0 U
TETRACHLOROETHYLENE(PCE)*	5	10.0 U	1.0 U	1.0 U	1.0 U
TOLUENE*	5	10.0 U	1.0 U	1.0 U	1.0 U
TRANS-1,2-DICHLOROETHENE	5	10.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROETHYLENE (TCE)*	5	10.0 U	1.0 U	1.0 U	1.0 U
TRICHLOROFLUOROMETHANE	5	1.0 U	1.0 U	1.0 U	1.0 U
VINYL CHLORIDE*	2	20.0 U	2.0 U	2.0 U	2.0 U
XYLENES, TOTAL	NA	20.0 U	2.0 U	2.0 U	2.0 U
TOTAL TARGET VOCs	NA	**623**	10.0 U	10.0 U	**39**

Table 1-6 Summary of Latest Analytical Results for Off-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: / Date: / Screening Criteria [1]	MW-02 21209 02/12/09	MW-06 21209 02/12/09	MW-07 21209 02/12/09	MW-11 21109 02/11/09
SVOCs by Method SW8270C (µg/L)					
2,4-DIMETHYLPHENOL	50	10.0 U	10.0 U	10.0 U	10.0 U
2-METHYLNAPHTHALENE	NA	10.0 U	10.0 U	10.0 U	10.0 U
2-METHYLPHENOL (O-CRESOL)*	NA	10.0 U	10.0 U	10.0 U	10.0 U
4-CHLOROANILINE	5	20.0 U	20.0 U	20.0 U	20.0 U
4-METHYLPHENOL (P-CRESOL)*	NA	10.0 U	10.0 U	10.0 U	**3.2 J**
4-NITROANILINE	5	10.0 U	10.0 U	10.0 U	10.0 U
ACETOPHENONE	NA	10.0 U	10.0 U	10.0 U	10.0 U
BENZALDEHYDE	NA	10.0 U	10.0 U	10.0 U	10.0 U
BIPHENYL (DIPHENYL)	5	10.0 U	10.0 U	10.0 U	10.0 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	1	10.0 U	10.0 U	10.0 U	10.0 U
BIS(2-ETHYLHEXYL) PHTHALATE	5	10.0 U	**15.2**	10.0 U	10.0 U
DIETHYL PHTHALATE	50	10.0 U	10.0 U	10.0 U	10.0 U
DIMETHYL PHTHALATE	50	20.0 UJ	20.0 UJ	20.0 UJ	20.0 UJ
NITROBENZENE	0.4	10.0 U	10.0 U	10.0 U	10.0 U
PHENOL	1	10.0 U	10.0 U	10.0 U	10.0 U

Table 1-6 Summary of Latest Analytical Results for Off-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: Date: Screening Criteria (1)

Key:

(g) = Guidance value (no applicable standard).

J = Estimated value.

U = Not detected (lab reporting limit shown).

UJ = Not detected/Estimated Value.

µg/L = Micrograms per liter.

mg/L = Milligrams per liter.

-- = Analyte not analyzed for.

VOCs = Volatile organic compounds.

/Q Designates field duplicate sample.

* = Target Compound.

Notes:

1. Shaded cells exceed

2. Bold values denote

Note:

[1] New York State Department of Environmental Conservation, Technical and Operational Guidance Series Memorandum #1.1.1: *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations,* 1998 (with updates), Class GA Groundw

Table 1-7 Summary of Latest Analytical Results for On-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: / Date: / Screening Criteria [1]	HEX-IW01-12062011 12/06/11	HEX-MW08-12062011 12/06/11	HEX-MW13-12062011 12/06/11	HEX-MW14-12062011 12/06/11	HEX-MW15-12062011 12/06/11	HEX-MW16-12072011 12/07/11	HEX-MW17-12072011 12/07/11
Mertals by Method SW6010B (mg/L)								
ALUMINUM	NA	**0.92**	**0.089 J**	**0.46**	**2.7**	**0.33**	**3.3**	**5.1**
ANTIMONY	0.003	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	**0.02**	0.02 U
ARSENIC	0.025	**0.024**	0.01 U	**0.012**	0.01 U	0.01 U	**0.081**	0.01 U
BARIUM	1	**0.13**	**0.36**	**0.16**	**0.16**	**0.2**	**0.05**	**0.12**
BERYLLIUM	0.003	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	**0.0014 J**
CADMIUM	0.005	**0.00055 J**	**0.00035 J**	**0.00079 J**	**0.0013**	**0.00072 J**	**0.0013**	**0.003**
CALCIUM*	NA	**197**	**568**	**473**	**215**	**310**	**350**	**203**
CHROMIUM, TOTAL	0.05	**0.25**	**0.054**	**0.15**	**0.56**	**0.23**	**0.35**	**0.77**
COBALT	NA	**0.027**	**0.0013 J**	**0.076**	**0.024**	**0.044**	**0.062**	**0.078**
COPPER	0.2	**0.3**	0.01 U	**0.068**	**0.12**	**0.033**	**6.3**	**0.81**
IRON*	0.3	**101**	**16**	**89**	**50**	**65**	**368**	**125**
LEAD	0.025	**0.0056**	0.005 U	**0.009**	**0.015**	0.005 U	**0.039**	**0.023**
MAGNESIUM*	35	**78**	**176**	**183**	**83**	**120**	**61**	**65**
MANGANESE*	0.3	**3.2**	**10**	**15**	**9**	**18**	**10**	**9.6**
NICKEL	0.1	**0.23**	**0.32**	**0.7**	**0.14**	**0.23**	**1.2**	**0.31**
POTASSIUM*	NA	**86**	**28**	**112**	**87**	**88**	**101**	**56**
SELENIUM	0.01	0.015 U	0.015 U	**0.019**	0.015 U	**0.012 J**	0.015 U	0.015 U
SODIUM*	20	**3420**	**431**	**4300**	**1300**	**1770**	**3560**	**877**
VANADIUM	NA	**0.027**	**0.026**	**0.025**	**0.027**	**0.02**	**0.036**	**0.065**
ZINC	2	**0.076**	**0.0049 J**	**0.17**	**0.68**	**0.58**	**1.4**	**7.1**
TOTAL 6 COMMON METALS	NA	**3885**	**1229**	**5172**	**1744**	**2371**	**4450**	**1336**
Mercury by Method SW7470A (mg/L)								
MERCURY	0.0007	**0.00038**	**0.00014 J**	0.0002 U	**0.00079**	0.0002 U	**0.023**	**0.025**

Table 1-7 Summary of Latest Analytical Results for On-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: Date: Screening Criteria [1]	HEX-IW01-12062011 12/06/11	HEX-MW08-12062011 12/06/11	HEX-MW13-12062011 12/06/11	HEX-MW14-12062011 12/06/11	HEX-MW15-12062011 12/06/11	HEX-MW16-12072011 12/07/11	HEX-MW17-12072011 12/07/11
VOCs by Method SW8260B (µg/L)								
1,1,1-TRICHLOROETHANE	5	250 U	250 U	250 U	**1900**	**2200**	**1600**	**3800**
1,1-DICHLOROETHANE	5	**170 J**	**780**	**840**	**1500**	**1600**	**430**	**1900**
1,1-DICHLOROETHENE	5	250 U	250 U	250 U	**280**	**250**	100 U	**210 J**
1,2-DICHLOROBENZENE	3	250 U	250 U	250 U	**710**	**1100**	**1300**	**3000**
1,2-DICHLOROETHANE*	0.6	**1700**	**3000**	**54000**	**87000**	**150000**	**6500**	**360000**
ACETONE*	50	**5200**	**650000**	**120000**	**77000**	**110000**	**1400**	**38000**
BENZENE*	1	**1200**	**45000**	**28000**	**16000**	**24000**	**180**	**13000**
BROMOMETHANE	5	250 U	250 U	250 U	250 U	250 U	**430**	250 U
CHLOROBENZENE*	5	**770**	**7900**	**2300**	**7700**	**6600**	**350**	**8000**
CHLOROFORM	7	250 U	250 U	**220 J**	**9500**	**5800**	100 U	**3800**
CHLOROMETHANE	5	250 U	250 U	250 U	250 U	250 U	**110**	250 U
CIS-1,2-DICHLOROETHYLENE*	5	**3800**	**6300**	**37000**	**55000**	**38000**	**220**	**4900**
CYCLOHEXANE	NA	250 U	250 U	250 U	250 U	250 U	**100**	250 U
ETHYLBENZENE	5	**390**	**1300**	**1100**	**610**	**700**	100 U	**330**
METHYL ETHYL KETONE (2-BUTANONE)	50	2500 U	**1800 J**	2500 U	2500 U	2500 U	1000 U	2500 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	NA	1300 U	**890 J**	1300 U	1300 U	1300 U	500 U	1300 U
METHYLCYCLOHEXANE	NA	250 U	250 U	250 U	250 U	250 U	**47 J**	250 U
METHYLENE CHLORIDE	5	250 U	**1900**	**8900**	**3700**	**6400**	**130**	**14000**
TETRACHLOROETHYLENE(PCE)*	5	**200 J**	250 U	**17000**	**9500**	**13000**	**4000**	**26000**
TOLUENE*	5	**19000**	**69000**	**120000**	**150000**	**110000**	**1800**	**110000**
TRANS-1,2-DICHLOROETHENE	5	250 U	250 U	250 U	250 U	**250**	100 U	250 U
TRICHLOROETHYLENE (TCE)*	5	**650**	**130 J**	**9200**	**29000**	**45000**	**1700**	**86000**
TRICHLOROFLUOROMETHANE	5	250 U	250 U	250 U	250 U	250 U	100 U	250 U
VINYL CHLORIDE*	2	**680**	**8700**	**3500**	**8000**	**9200**	**130**	**2100**
XYLENES, TOTAL	NA	**2000**	**5100**	**4800**	**2500**	**2500**	200 U	**1400**
TOTAL TARGET VOCs	NA	**33200**	**790030**	**391000**	**439200**	**505800**	**16280**	**648000**

Table 1-7 Summary of Latest Analytical Results for On-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: Date: Screening Criteria [1]	HEX-IW01-12062011 12/06/11	HEX-MW08-12062011 12/06/11	HEX-MW13-12062011 12/06/11	HEX-MW14-12062011 12/06/11	HEX-MW15-12062011 12/06/11	HEX-MW16-12072011 12/07/11	HEX-MW17-12072011 12/07/11
SVOCs by Method SW8270C (µg/L)								
2,4-DIMETHYLPHENOL	50	240 U	2400 U	470 U	470 U	480 U	240 U	470 U
2-METHYLNAPHTHALENE	NA	**33 J**	2400 U	470 U	**110 J**	480 U	240 U	470 U
2-METHYLPHENOL (O-CRESOL)*	NA	**400 B**	**7600 B**	**4200 B**	**1600 B**	**2300 B**	240 U	**860 B**
4-CHLOROANILINE	5	**68 J**	**810 J**	**200 J**	**580**	**600**	240 U	**710**
4-METHYLPHENOL (P-CRESOL)*	NA	**920**	**52000**	**12000**	**7300**	**11000**	480 U	**2100**
4-NITROANILINE	5	470 U	4700 U	940 U	950 U	950 U	480 U	**25 J**
ACETOPHENONE	NA	**99 J**	**390 J**	470 U	470 U	**310 J**	240 U	**220 J**
BENZALDEHYDE	NA	240 U	2400 U	470 U	470 U	**34 J**	**1900**	**410 J**
BIPHENYL (DIPHENYL)	5	**60 J**	2400 U	470 U	470 U	480 U	**38 J**	**78 J**
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	1	240 U	**1600 J**	**1100**	**180 J**	**300 J**	240 U	470 U
BIS(2-ETHYLHEXYL) PHTHALATE	5	240 U	2400 U	470 U	**1900**	480 U	**190 J**	**910**
DIETHYL PHTHALATE	50	**47 J**	**590 J**	**1900**	**560**	**1300**	**45 J**	**300 J**
DIMETHYL PHTHALATE	50	240 U	2400 U	**730**	**98 J**	**130 J**	240 U	470 U
NITROBENZENE	0.4	240 U	2400 U	**2100**	**17000**	**4700**	**60 J**	**4800**
PHENOL	1	240 U	**5900**	**960**	**960**	**820**	240 U	470 U

Table 1-7 Summary of Latest Analytical Results for On-site Groundwater Samples
Former Hexagon Laboratories Site

Analyte	Sample ID: / Date: / Screening Criteria [1]	HEX-IW01-12062011 12/06/11

Key:

(g) = Guidance value (no applicable standard).

J = Estimated value.

U = Not detected (lab reporting limit shown).

UJ = Not detected/Estimated Value.

µg/L = Micrograms per liter.

mg/L = Milligrams per liter.

-- = Analyte not analyzed for.

VOCs = Volatile organic compounds.

/Q Designates field duplicate sample.

* = Target Compound.

Notes:

1. Shaded cells exceed the screening value.
2. Bold values denote positive hits.

Note:

[1] New York State Department of Environmental Conservation, Technical and Operational Guidance Series Memorandum #1.1.1: *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations,* 1998 (with updates), Class GA Groundwater Standards and Guidance Values.

Table 3-1: Monitoring/Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
Soil Cover System	annual	soil cover system	Inorganics, SVOCs, VOCs
Media	annual	groundwater	Inorganics, SVOCs, VOCs

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

Table 3-2: Schedule of Monitoring/Inspection Reports

Task	Reporting Frequency*
Site Inspection	Annual and after each severe weather condition that could affect the ECs
Groundwater Monitoring	Annual
Cover System Monitoring	Annual

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

FIGURES

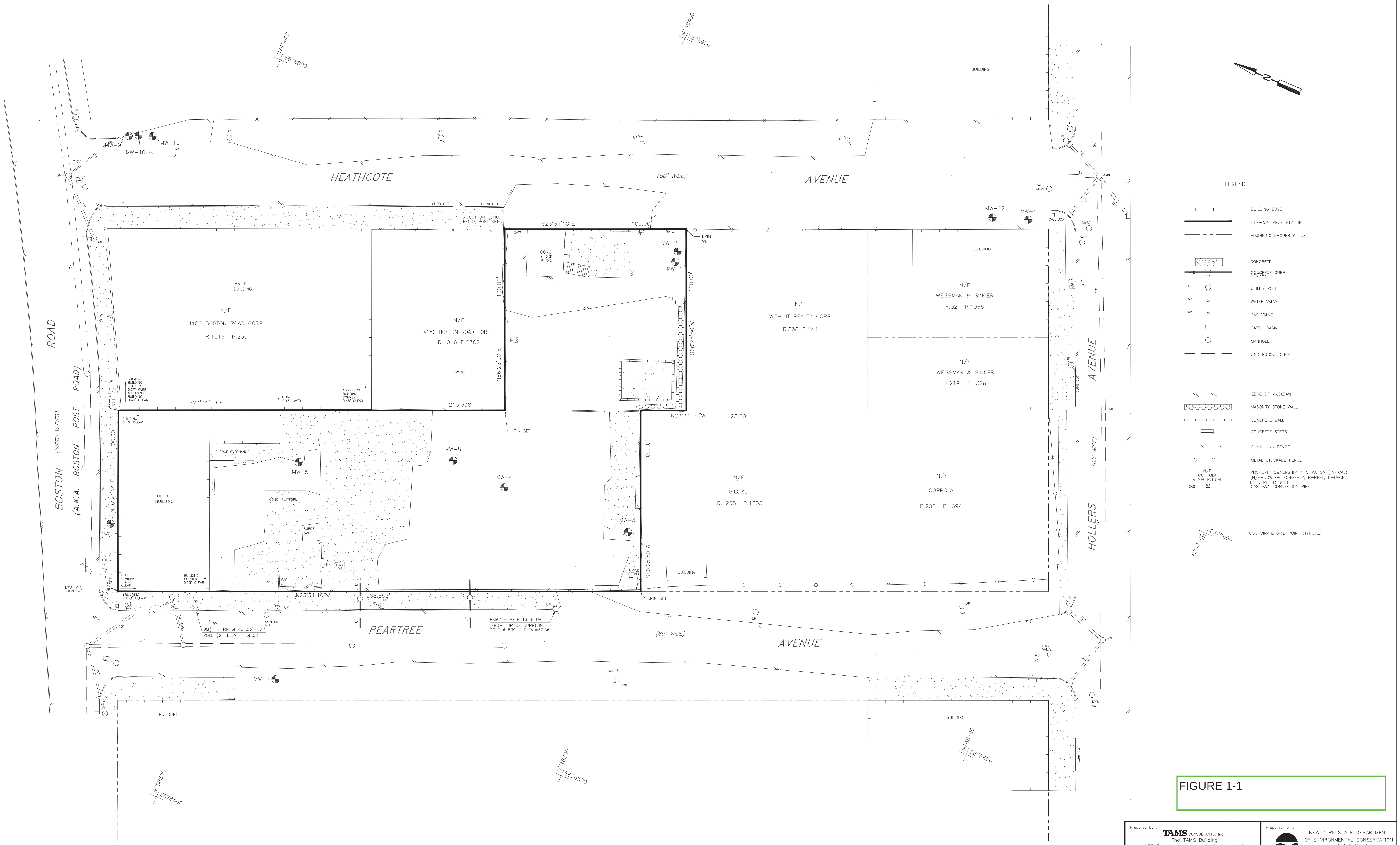


FIGURE 1-1

REFERENCES:

1. INFORMATION ON FILE AT THE BRONX BOROUGH HALL.
2. DEEDS OF RECORD.
3. VERTICAL DATUM: NGVD 1929.
4. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE, NAD 1983 FROM NEW YORK STATE DEPARTMENT OF TRANSPORTATION SURVEY INFORMATION.

NOTES:

1. BASED ON SURVEY OF HEXAGON LABORATORIES SITE PREPARED BY YEC, INC., VALLEY COTTAGE, NEW YORK.
2. HEXAGON LABORATORIES PROPERTY:
   TAX LOT: 17-5283-43
   RECORD DEED: REEL 460, PAGE 601
   AREA: 38,845 S.F. (0.892 AC.)

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by: TAMS CONSULTANTS, Inc. The TAMS Building 655 Third Avenue, New York, New York

Prepared for: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION 50 Wolf Road Albany, New York 12233

DESIGNED BY:

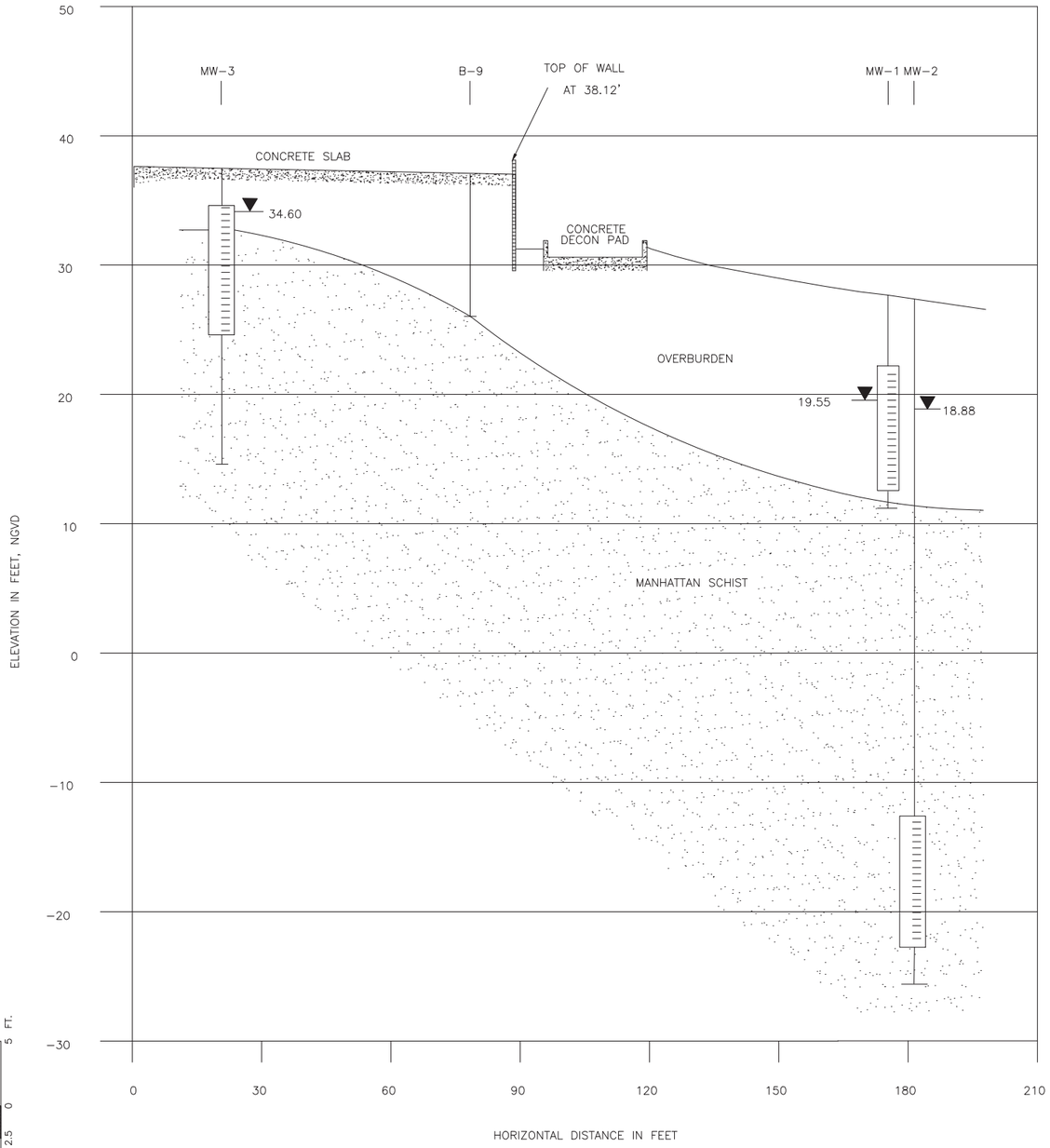
DRAWN BY:

CHECKED BY:

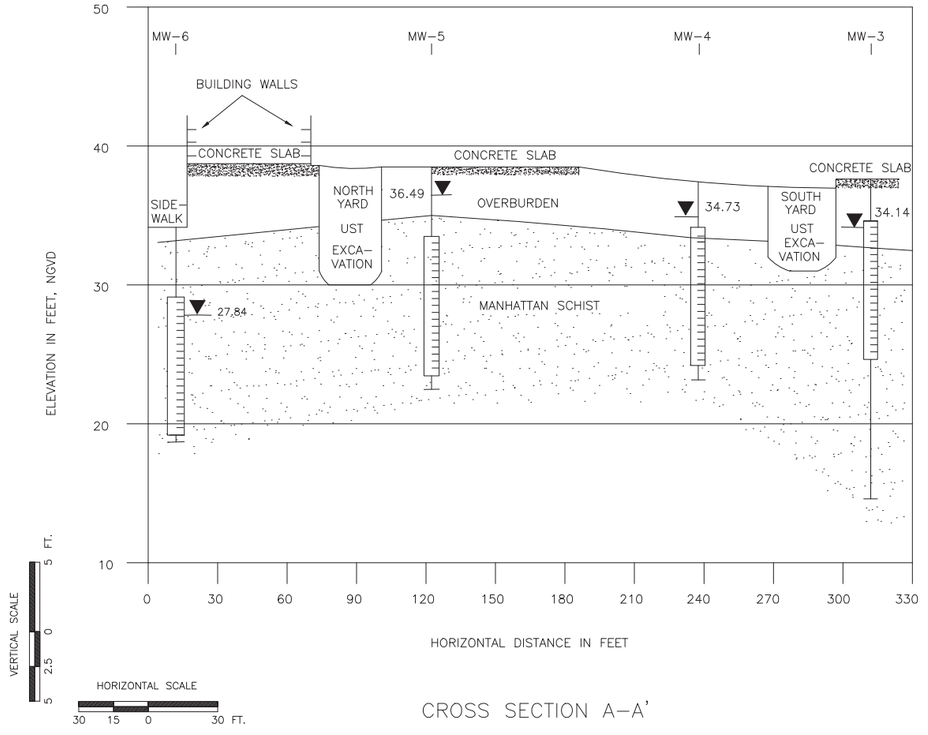
HEXAGON LABORATORIES SITE
City of New York
Bronx County, New York

TOPOGRAPHIC BASE MAP

SUBMITTED BY:	DATE:	SCALE:	DRAWING NO.:
PDP	AUGUST 1999	1" = 20'	1-2



CROSS SECTION B–B'



CROSS SECTION A–A'

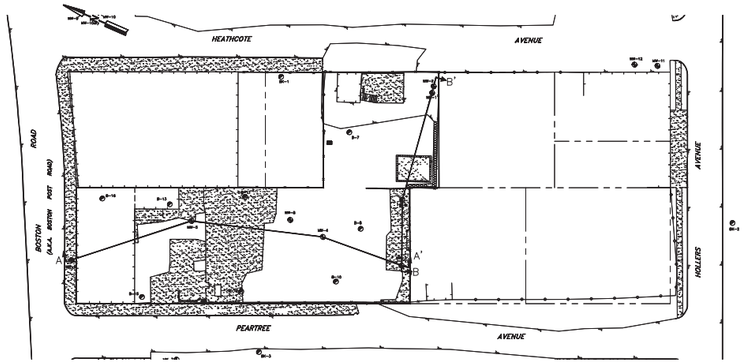


FIGURE 1-2

LEGEND

- 18.88 — GROUNDWATER ELEVATION IN FEET, NGVD (TYP.)
- MW-1 — MONITORING WELL/BORING DESIGNATION (TYP.)
- MONITORING WELL SCREENED INTERVAL
- MAXIMUM DEPTH OF BORING

NOTE: GROUNDWATER ELEVATIONS MEASURED ON MARCH 5, 1998.

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by : TAMS CONSULTANTS, Inc.
The TAMS Building
655 Third Avenue, New York, New York

Prepared for : NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
50 Wolf Road
Albany, New York 12233

DESIGNED BY :	PK
DRAWN BY :	PDP
CHECKED BY :	MT
SUBMITTED BY :	PDP
DATE :	AUGUST 1999
SCALE :	AS SHOWN
DRAWING NO. :	3-3

HEXAGON LABORATORIES SITE

City of New York
Bronx County, New York

GEOLOGIC CROSS SECTIONS

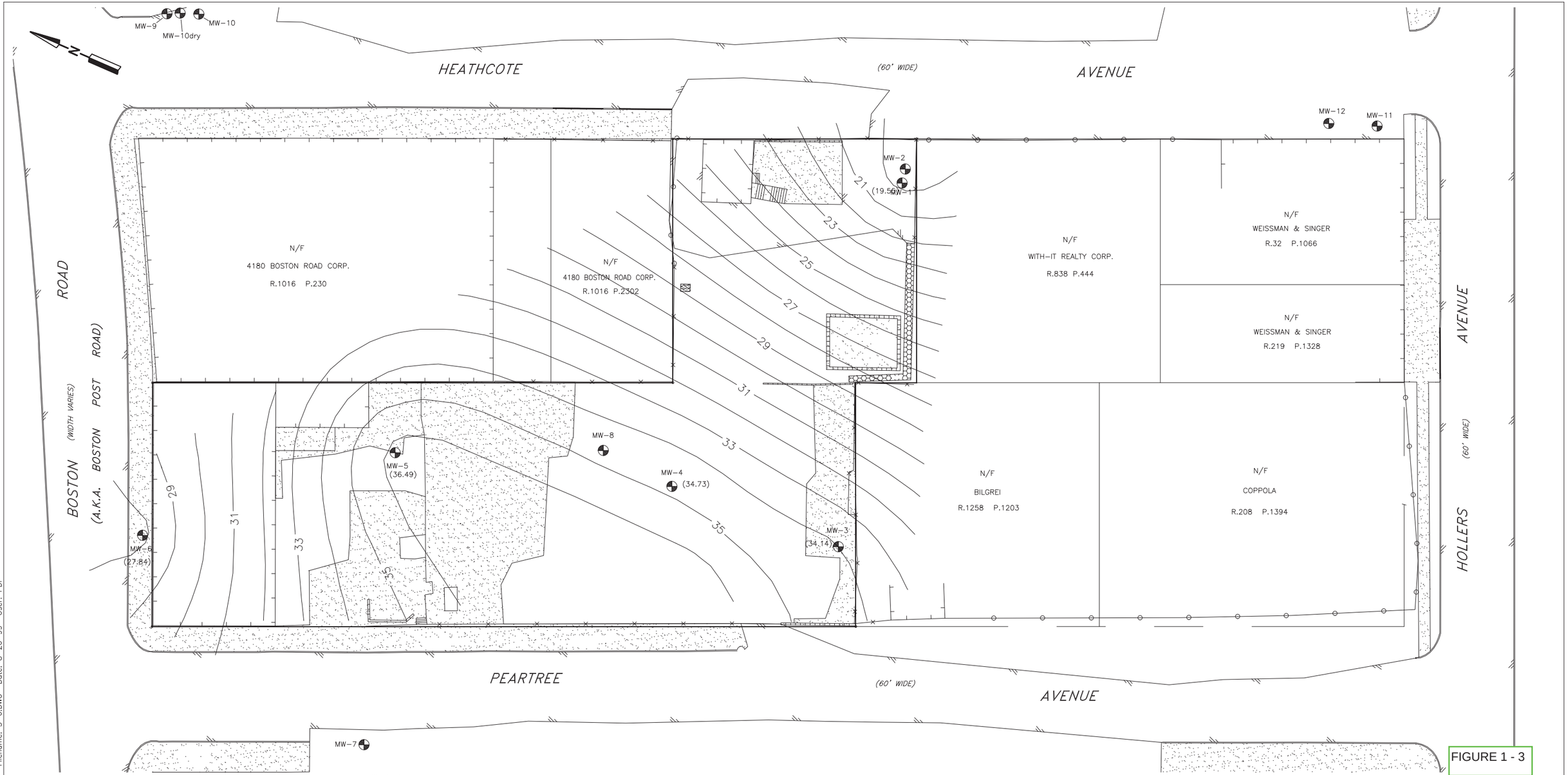


FIGURE 1 - 3

LEGEND

- BUILDING EDGE
- HEXAGON PROPERTY LINE
- ADJOINING PROPERTY LINE
- EDGE OF MACADAM
- MASONRY STONE WALL
- CONCRETE WALL
- CONCRETE STEPS
- CHAIN LINK FENCE
- METAL STOCKADE FENCE
- (36.24) GROUNDWATER ELEVATION IN FEET (TYP.), NGVD
- 36 GROUNDWATER ISOPLETH (TYP.), 1 FT. CONTOUR INTERVAL

SCALE

40 20 0 40 FT.

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by :
TAMS CONSULTANTS, Inc.
The TAMS Building
655 Third Avenue, New York, New York

Prepared for :
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
50 Wolf Road
Albany, New York 12233

DESIGNED BY : PK
DRAWN BY : PDP
CHECKED BY : MT

HEXAGON LABORATORIES SITE
New York City
Bronx County, New York

GROUNDWATER TABLE CONTOUR ELEVATION MAP – MARCH 5, 1998

SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
PDP	AUGUST 1999	AS SHOWN	3-6

U:\PROJECT.33\6851HEXL.DEC\R\FIGURES\8-99Sub Filename: 3-6.DWG Date: 8-20-99 User: PDP

LEGEND

Symbol	Description
BK, B	SOIL BORING
MW	MONITORING WELL
OM-1	OILY MATERIAL SAMPLE
SS-5	SURFACE SOIL SAMPLE (TYP.)
NPT-1	UST SUBSURFACE SOIL SAMPLE (TYP.)
OP1	FLOOR SLAB SAMPLE (TYP.)
	BUILDING EDGE
	HEXAGON PROPERTY LINE
	ADJOINING PROPERTY LINE
	CONCRETE
	CONCRETE CURB
	EDGE OF MACADAM
	MASONRY STONE WALL
	CONCRETE WALL
	CONCRETE STEPS
	CHAIN LINK FENCE
	METAL STOCKADE FENCE
N/F COPPOLA R.208 P.1394	PROPERTY OWNERSHIP INFORMATION (TY (N/F=NOW OR FORMERLY, R=REEL, P= DEED REFERENCE)

NOTES:

1. ALL MONITORING WELL LOCATIONS AND BORING B-9, B-11, B-12, B-15, BK-1, BK-2, AND BK-3 LOCATIONS WERE SURVEYED BY YEC, INC.. ALL OTHER SAMPLING LOCATIONS ARE APPROXIMATE BASED ON TAMS FIELD NOTES.
2. FLOOR SLAB SAMPLES WERE COLLECTED BY TRADE-WINDS ENVIRONMENTAL RESTORATION, INC. AS PART OF THE IRM.
3. ONE SAMPLE OF SOIL EXCAVATED FROM THE SOUTH YARD UST EXCAVATION WAS COLLECTED BY TAMS. THIS EXCAVATED SOIL SAMPLE, SYTEX-1, IS NOT INCLUDED IN THIS FIGURE FOR CLARITY PURPOSES.
4. SIX SAMPLES OF SOIL EXCAVATED FROM THE SOUTH YARD UST EXCAVATION WERE COLLECTED BY TRADE-WINDS ENVIRONMENTAL RESTORATION, INC. OVER THE COURSE OF THE IRM. THESE SAMPLES (LD1-2-3, SYA, #1-2-3, SYS1, SYS2, AND SYS3) ARE NOT INCLUDED IN THIS FIGURE FOR CLARITY PURPOSES.
5. FOUR SAMPLES OF SOIL EXCAVATED FROM THE NEW PLANT UST EXCAVATION WERE COLLECTED BY TRADE-WINDS ENVIRONMENTAL RESTORATION, INC. OVER THE COURSE OF THE IRM. THESE SAMPLES (FOT#1, FOT#2, FO1, AND FO2) ARE NOT INCLUDED IN THIS FIGURE FOR CLARITY PURPOSES.
6. SYTC-1 IS A COMPOSITE IN-SITU SIDEWALL SAMPLE OF SYTN-1, SYTS-1, SYTE-1 AND SYTW-1.
7. FIVE SURFACE SOIL SAMPLES (SS6 THROUGH SS10) AND FIVE SUBSURFACE SOIL SAMPLES (B-17 THROUGH B-21) WERE COLLECTED AS PART OF THE PHASE II REMEDIAL INVESTIGATION.

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

FIGURE 1 - 4

Prepared by : TAMS CONSULTANTS, Inc.
The TAMS Building
655 Third Avenue, New York, New York

Prepared for : NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
50 Wolf Road
Albany, New York 12233

HEXAGON LABORATORIES SITE

City of New York
Bronx County, New York

SAMPLING LOCATIONS

DESIGNED BY :	DRAWN BY :	CHECKED BY :	SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
PDP	PDP	PK	PDP	AUGUST 1999	1" = 20'	2-1

APPENDIX A – EXCAVATION WORK PLAN

A-1 NOTIFICATION

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

Mr. Michael Mason, P. E.

New York State Department of Environmental Conservation

Division of Environmental Remediation

625 Broadway

Albany, NY 12233-7011

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,
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work,
- A summary of the applicable components of this EWP,
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120,
- A copy of the contractor's health and safety plan, in electronic format, if it differs from the HASP provided in Appendix D of this document,
- Identification of disposal facilities for potential waste streams,

- Identification of sources of any anticipated backfill, along with all required chemical testing results.

A-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 contaminated material (remaining contamination). 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 COC.

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

A-3 STOCKPILE METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Appropriate erosion and sediment controls will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum 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 NYSDEC.

A-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 all 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).

A truck wash will be operated on-site. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

As an alternative, a truck loading area and droppings protection method may be employed such that the wheels and exterior of the truck remain clean during the loading process.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring 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.

A-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials 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.

Truck transport routes shall be proposed as part of the notice required in A-1 above. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. The route selected should be 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 off-site queuing of trucks entering the

facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

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

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 on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

A-6 MATERIALS DISPOSAL OFF-SITE

All soil or fill excavated and removed from the site will be characterized for proper disposal. If found to be contaminated and regulated material it will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated characterization results will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site 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 fill and contaminated non-regulated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR 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 (6NYCRR Part 360-16 Registration Facility).

A-7 MATERIALS REUSE ON-SITE

The chemical criteria for on-site reuse of material is NYSDEC TAGM 4046. The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site.

Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for re-use on-site will be placed below the demarcation layer or impervious surface, 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 on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval.

A-8 FLUIDS MANAGEMENT

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, but will be managed off-site.

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 and may require an approved treatment process prior to discharge.

A-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 Record of Decision. The demarcation layer immediately below the bluestone surface layer, consisting of geotextile material will be replaced to provide a visual reference to the top of the 'Contamination Reduction Zone', the zone that requires adherence to special conditions for disturbance of potentially contaminated or remaining contaminated soils defined in this Site Management Plan. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt or an impermeable clay layer or membrane), this will constitute a modification of the cover element of the remedy and the upper surface of the 'Remaining Contamination Zone." A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the Site Management Plan.

If the purpose of the work that disturbs the soil cover system is to erect a permanent structure for any type of occupancy, then there must be a soil vapor mitigation

system as part of any foundation system for such a structure. The intended soil vapor mitigation system must be approved by NYSDEC prior to disturbance of the existing soil cover system.

A-10 BACKFILL FROM OFF-SITE SOURCES

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 contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards for the site are as listed in NYSDEC TAGM 4046. 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 not immediately placed in the excavation will be stockpiled separately from excavated materials and covered to prevent dust releases.

A-11 STORMWATER POLLUTION PREVENTION

Because this site is less than 1-acre in size a Stormwater Pollution Prevention Plan is not required. However, soil erosion and sediment control best management practices should be employed during any soil disturbance work at the site. Erosion control measures and sediment barriers, traps, and collection devices 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, trap, and collection devices functional.

All undercutting, erosion, or flow by-passing of such control measures shall be repaired immediately with appropriate materials or adjustments of placement.

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.

A-12 COMMUNITY AIR MONITORING PLAN

Any intrusive work at the site will require a Community Air Monitoring Plan (CAMP) unless characterization sampling indicates no concern. The work plan of the notice of part A-1 above shall include a CAMP that is in compliance with Appendix 1A of DER-10.

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

A-13 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include covering of excavated material stockpiles and application of a water-based odor suppression solution or foam (BioSolve or a similar product) to impacted material during active excavation operations. 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 property owner's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams or odor suppression solutions to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances

will include: (d) direct load-out of soils to trucks for off-site disposal; and, (f) use of staff to monitor odors in surrounding neighborhoods add others as necessary.

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

A-14 DUST CONTROL PLAN

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

- Dust suppression will be achieved through the use of a dedicated on-site 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.
- Removal of the bluestone layer will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- On-site vehicle routing will be limited in total area to minimize the area required for water truck sprinkling.

APPENDIX B – ENVIRONMENTAL NOTICE

ENVIRONMENTAL NOTICE

THIS ENVIRONMENTAL NOTICE is made the ___ day of _____ 2012, by the New York State Department of Environmental Conservation (Department), having an office for the transaction of business at 625 Broadway, Albany, New York 12233.

WHEREAS, a 0.9-acre (1.1 acres including the previously leased property south east of the site now owned by Bilgrei) parcel of real property located at 3536 Peartree Avenue in the Eastchester section of Bronx County, New York which is by deed dated_____ and recorded in Bronx County Clerk's office on _____ in Book___ of Deeds at Page ___ and which is identified by Lot number 43 (the Property) and the formally leased property is Lot number 37; and being more particularly described in Appendix A, attached to this notice and made a part hereof, and hereinafter referred to as "the Property," is the subject of a remedial program which was conducted by the Department as part of the New York State Superfund Program: and

WHEREAS, the Department approved a cleanup to address contamination disposed at the Property and such cleanup was conditioned upon certain limitations.

NOW, THEREFORE, the Department provides notice that:

FIRST, the Property subject to this Environmental Notice is as shown on a map attached to this Notice 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 Relevent Agency," is first obtained, where contamination remains at the Property there shall be no disturbance or excavation of the Property which threatens the integrity of the engineering controls, which will, or is reasonably anticipated to, interfere significantly with any proposed, ongoing, or completed remedial program at the site, or which results or may result in a significantly increased threat of harm or damage at the site. A violation of this provision is a violation of 6 NYCRR 375-1.11(b)(2).

THIRD, no person shall disturb, remove, or otherwise interfere with the installation, use, operation, and maintenance of engineering controls required for the remedy or with performance of the Department approved Site Management Plan unless in each instance they first obtain a written waiver of such prohibition from the Department or Relevant Agency.

FOURTH, the remedy was designed to be protective for the following use: surface or immediate subsurface. Therefore, any use for purposes other than for surface or immediate subsurface use without the express written waiver of such prohibition by the Department or Relevant Agency may result in a significantly increased threat of harm or damage at the site.

FIFTH, no person shall use 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 of Relevant Agency. Use of groundwater without appropriate treatment may result in a significantly increased threat of harm or damage at the site.

SIXTH, upon change of use or new construction on the site, the site remedy requires evaluation of the potential for soil vapor intrusion and the possibility of adverse impacts on indoor air, and compliance with New York State Department of Health Guidance for Evaluation Soil Vapor Intrusion to address current or potential human exposures.

SEVENTH, it is a violation of 6 NYCRR 375-1.11(b) to use the Property in a manner inconsistent with this environmental notice.

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

By: _____

_____, Director
Division of Remediation

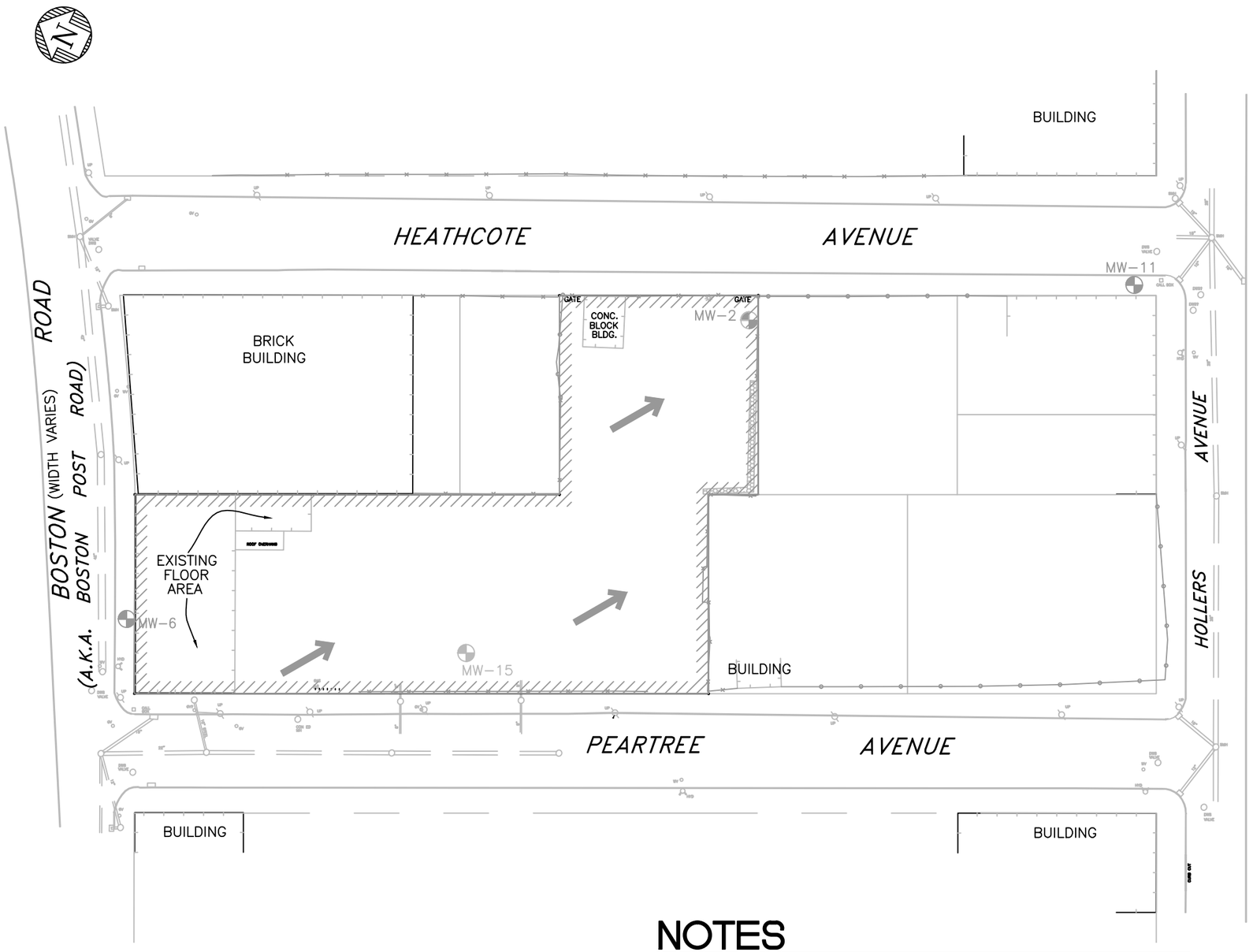
STATE OF NEW YORK) ss:
COUNTY OF ALBANY)

On the __ day of _____ in the year 2012, before me, the undersigned, personally appeared Dale Desnoyers, personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public – State of New York

APPENDIX C – SITE MAP

F:\Hexagon\2012 figure update\Appendix C site map.dwg



SCALE IN FEET

0 60 120 180

LEGEND

- MW — EXISTING MONITORING WELL
- BUILDING EDGE
- HEXAGON PROPERTY LINE
- ADJOINING PROPERTY LINE
- CONCRETE CURB
- HYD — HYDRANT
- UP — UTILITY POLE
- WV — WATER VALVE
- GV — GAS VALVE
- CATCH BASIN
- MANHOLE
- UNDERGROUND PIPE
- MASONRY STONE WALL
- CHAIN LINK FENCE
- METAL STOCKADE FENCE
- GAS — GAS MAIN CONNECTION PIPE
- APPROXIMATE GROUNDWATER FLOW DIRECTION

EXISTING WELL TABLE			
WELL ID	DEPTH TO WATER (ft)	TOTAL DEPTH (ft)	TOP OF CASING (ft)
MW-2	–	50.79	–
MW-6	–	14.89	–
MW-11	8.85	16.39	–
MW-15	8.59	49.76	42.46

NOTES

1. SITE BASE MAP HEXAGON LABORATORIES RI/FS BRONX, BRONX COUNTY NY A0126 SUPPLIED BY YEC INC, VALLEY COTTAGE, NY.
2. WELL LOCATIONS ARE APPROXIMATE.
3. DEPTH TO WATER INFORMATION FROM DECEMBER 2010.

ecology and environment

ENVIRONMENTAL NOTICE: APPENDIX C

SITE MAP
HEXAGON LABORATORY SITE
BRONX COUNTY, NEW YORK

APPENDIX D – GENERIC HEALTH AND SAFETY PLAN

GENERIC
HEALTH AND SAFETY PLAN

Project: FORMER HEXAGON LABORATORIES SITE _____

Project No.: _____

Project Location: 3536 PEAR TREE AVE, BRONX, NY 10475_____

Prepared by: _____ Date Prepared:_____

Approved by: _____ Date Approved: _____

1. INTRODUCTION

1.1 POLICY

It is the Consultant's policy to ensure the health and safety of its employees, the public, and the environment during the performance of work it conducts. This generic health and safety plan (GHASP) establishes the procedures and requirements to ensure the health and safety of the Consultant's employees for the above-named project. The Consultant's overall safety and health program is described in the Consultant's *Corporate Health and Safety Program* (CHSP). After reading this plan, applicable Consultant employees shall read and sign the Consultant's Health and Safety Plan Acceptance form.

This GHASP has been developed for the sole use of the Consultant's employees and is not intended for use by firms not participating in the Consultant's training and health and safety programs. Subcontractors are responsible for developing and providing their own safety plans.

This GHASP has been prepared to meet the following applicable regulatory requirements and guidance:

Applicable Regulation/Guidance
29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER)
Other:

1.2 SCOPE OF WORK

Description of Work: This project involves operations, maintenance, and monitoring of a NYSDEC inactive hazardous waste site, including sampling of contaminated environmental media, such as groundwater.

Equipment/Supplies: Attachment 1 contains a checklist of equipment and supplies that will be needed for this work.

The following is a description of each numbered task:

Task Number	Task Description
1	Long-term monitoring and reporting
2	Operations and maintenance (O&M) of soil cover system, monitoring-well closure systems, and access system.

1.3 SITE DESCRIPTION

Site Map: A site map is attached at the end of this plan (see Attachment 2).

Site History/Description (see execution work plan for detailed description): The Former Hexagon Laboratories (Hexagon) site is located at 3536 Peartree Avenue in the Eastchester section of Bronx County, New York. The surrounding area is a generally densely populated urban area. The site is fully fenced with a 6-foot-high chain-link fence with lockable gates. Hexagon Laboratories manufactured pharmaceuticals, pharmaceutical intermediates, and a large variety of other organic chemicals from the mid-1940s through 1988. Hexagon was also a hazardous waste generator, and a transport, storage and disposal facility. The facility has a history of chemical spills dating back to the 1980s when local elected officials received complaints about dumping by Hexagon. In December 1993, the site was reclassified as a Class 2 site because of contaminated groundwater. Hexagon was divided into Operable Units (OUs) 1 (soils) and 2 (groundwater) after completion of an investigation in 1998 indicating soil contamination and necessitating remediation because of high concentrations of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

Is the site currently in operation? __ Yes X No

Locations of Contaminants/Wastes: VOCs and SVOCs have been detected in the groundwater which ranges from 1 to 10 feet below ground surface.

Types and Characteristics of Contaminants/Wastes:

X Liquid	☐ Solid	☐ Sludge	X Gas/Vapor
X Flammable/Ignitable	X Volatile	☐ Corrosive	☐ Acutely Toxic
☐ Explosive	☐ Reactive	X Carcinogenic	☐ Radioactive
☐ Medical/Pathogenic	Other:		

2. ORGANIZATION AND RESPONSIBILITIES

The Consultant's field team personnel shall have on-site responsibilities as described in the Consultant's standard operating procedure (SOP) for Site Entry Procedures. The project team, including qualified alternates, is identified in Table 2-1.

Table 2-1 Project Team

Name	Site Role/Responsibility
TBD based on actual field crew and activities	Project Manager
TBD based on actual field crew and activities	Site Safety Officer
TBD based on actual field crew and activities	Team member

3. TRAINING

Prior to work, team personnel shall have received training as indicated in Table 3-1. As applicable, personnel shall have read the execution work plan, sampling and analysis plan, and/or quality assurance project plan prior to project work.

Table 3-1 Required Training

Training	Required
40-Hour OSHA HAZWOPER Initial Training and Annual Refresher (29 CFR 1910.120)	X
Current First Aid/CPR	X
Hazard Communication (29 CFR 1910.1200)	X
40-Hour Radiation Protection Procedures and Investigative Methods	
8-Hour General Radiation Health and Safety	
Radiation Refresher	
DOT Hazardous Material Shipping and appropriate recurrent training	X

Training	Required
Other:	

4. MEDICAL SURVEILLANCE

4.1 MEDICAL SURVEILLANCE PROGRAM

Field personnel shall actively participate in the Consultant's medical surveillance program as described in the CHSP and shall have received, within the past year, an appropriate physical examination and health rating.

The Consultant's health and safety record (HSR) form will be maintained on site by each employee for the duration of his or her work. Employees should inform the site safety officer (SSO) of any allergies, medical conditions, or similar situations that are relevant to the safe conduct of the work to which this GHASP applies.

Is there a concern for radiation at the site? ☐ Yes X No

If no, go to 5.1.

4.2 RADIATION EXPOSURE

4.2.1 External Dosimetry

Thermoluminescent Dosimeter (TLD) Badges: _____

Pocket Dosimeters: _____

_____

Other: _____

_____

4.2.2 Internal Dosimetry

☐ Whole body count ☐ Bioassay ☐ Other

Requirements: _____

_____

4.2.3 Radiation Dose

Dose Limits:

_____

_____

Site-Specific Dose Limits: _____

_____

ALARA Policy:

_____

5. SITE CONTROL

5.1 SITE LAYOUT AND WORK ZONES

Site Work Zones: Each well will be a work zone during the sampling of the well or maintenance of the well. Each soil boring will be a work zone during the soil sampling portion of cover system monitoring.

Site Access Requirements and Special Considerations: The Site is fully fenced and locked. Access can be gained by key from the Pear Tree Avenue side only.

Illumination Requirements: Work during daylight hours only.

Sanitary Facilities (e.g., toilet, shower, potable water): None at the site. McDonalds is around the corner. Containers of potable water must be brought to site.

On-Site Communications: Site is small and clear, visual communication is possible if too far for voice.

Other Site-Control Requirements: Vehicles should be left near the entry gate to not clutter the site. Equipment will move from well to well. Vehicle horn will act as emergency alarm.

5.2 SAFE WORK PRACTICES

Daily Safety Meeting: A daily safety meeting will be conducted and documented for all team personnel. The information and data obtained from applicable site characterization and analysis will be addressed in the safety meetings and also used to update this HASP, as necessary.

Work Limitations: Work shall be limited to a maximum of 12 hours per day. If 12 consecutive days are worked, at least one day off shall be provided before work is resumed. Work will be conducted in daylight hours unless prior approval is obtained. and the illumination requirements in 29 CFR 1910.120(m) are satisfied.

Weather Limitations: Work shall not be conducted during electrical storms. Work conducted in other inclement weather (e.g., rain and snow) will be approved by project management and the regional safety coordinator or designee.

Other Work Limitations:

Buddy System: Field work will be conducted in pairs of team members according to the buddy system.

Line of Sight: Each field team member shall remain in the line of sight and within verbal communication of at least one other team member.

Eating, Drinking, and Smoking: Eating, drinking, smoking, and the use of tobacco products shall be prohibited in the work zones, at a minimum, and shall only be permitted in designated areas.

Contamination Avoidance: Field personnel shall avoid unnecessary contamination of personnel, equipment, and materials to the extent practicable.

Sample Handling: Protective gloves of a type designated in Section 7 will be worn when containerized samples are handled for labeling, packaging, transportation, and other purposes.

Other Safe Work Practices:

6. HAZARD EVALUATION AND CONTROL

6.1 PHYSICAL HAZARD EVALUATION AND CONTROL

Potential physical hazards and their applicable control measures are described in Table 6-1 for each task.

Hazard	Task Number	Hazard Control Measures
Biological (e.g., flora and fauna)	1,2	Potential hazard: Bee stings, animal bites. Establish site-specific procedures for working around identified hazards. Other:
Cold Stress	1,2	Provide warm break area and adequate breaks. Provide warm non-caffeinated beverages. Promote cold-stress awareness. See *Cold-Stress Prevention and Treatment* (attached at the end of this plan if cold stress is a potential hazard).
Compressed Gas Cylinders	None	Use caution when moving or storing cylinders. A cylinder is a projectile hazard if it is damaged or its neck is broken. Store cylinders upright and secure them by chains or other means. Other:
Confined Space	None	Ensure compliance with 29 CFR 1910.146. See SOP for Confined Space Entry. Additional documentation is required. Other:
Drilling/ Direct Push	None	See SOP for Health and Safety on Drilling Rig Operations. Additional documentation may be required. Landfill caps will not be penetrated without prior discussions with corporate health and safety staff. Other:
Drums and Containers	1, 2	Ensure compliance with 29 CFR 1910.120(j). Consider unlabeled drums or containers to contain hazardous substances and handle accordingly until the contents are identified. Inspect drums or containers and assure integrity prior to handling. Move drums or containers only as necessary; use caution and warn nearby personnel of potential hazards. Open, sample, and/or move drums or containers in accordance with established procedures; use approved drum/container-handling equipment. Other:
Electrical	None	Ensure compliance with 29 CFR 1910 Subparts J and S. Locate and mark energized lines. De-energize lines as necessary. Ground all electrical circuits. Guard or isolate temporary wiring to prevent accidental contact. Evaluate potential areas of high moisture or standing water and define special electrical needs. Other:
Excavation and Trenching	None	Ensure that excavations comply with and personnel are informed of the requirements of 29 CFR 1926 Subpart P. Ensure that any required sloping or shoring systems are approved as per 29 CFR 1926 Subpart P. Identify special personal protective equipment (PPE) (see Section 7) and monitoring (see Section 8) needs if personnel are required to enter approved excavated areas or trenches. Maintain line of sight between equipment operators and personnel in excavations/trenches. Such personnel are prohibited from working in close proximity to operating machinery.

Hazard	Task Number	Hazard Control Measures
		Suspend or shut down operations at signs of cave in, excessive water, defective shoring, changing weather, or unacceptable monitoring results. Other:
Fire and Explosion	1, 2	Inform personnel of the location(s) of potential fire/explosion hazards. Venting zone of any open monitoring well. Establish site-specific procedures for working around flammables. Ensure that appropriate fire suppression equipment and systems are available and in good working order. Define requirements for intrinsically safe equipment. Identify special monitoring needs (see Section 8). Remove ignition sources from flammable atmospheres. Coordinate with local fire-fighting groups regarding potential fire/explosion situations. Establish contingency plans and review daily with team members. Other:
Heat Stress	1, 2	Provide cool break area and adequate breaks. Provide cool non-caffeinated beverages. Promote heat stress awareness. Use active cooling devices (e.g., cooling vests) where specified. See *Heat Stress Prevention and Treatment* (attached at the end of this plan if heat stress is a potential hazard).
Heavy Equipment Operation	None	Define equipment routes, traffic patterns, and site-specific safety measures. Ensure that operators are properly trained and equipment has been properly inspected and maintained. Verify back-up alarms. Ensure that ground spotters are assigned and informed of proper hand signals and communication protocols. Identify special PPE (Section 7) and monitoring (Section 8) needs. Ensure that field personnel do not work in close proximity to operating equipment. Ensure that lifting capacities, load limits, etc., are not exceeded. Other:
Heights (Scaffolding, Ladders, etc.)	None	Ensure compliance with applicable subparts of 29 CFR 1910. Identify special PPE needs (e.g., lanyards, safety nets) Other:
Noise	None	Establish noise level standards for on-site equipment/operations. Inform personnel of hearing protection requirements (Section 7). Define site-specific requirements for noise monitoring (Section 8). Other:
Overhead Obstructions	None	Wear hard hat. Other:
Power Tools	2	Ensure compliance with 29 CFR 1910 Subpart P. Other:
Sunburn	1, 2	Apply sunscreen. Wear hats/caps and long sleeves. Other:
Utility Lines	None	Identify/locate existing utilities prior to work. Ensure that overhead utility lines are at least 25 feet away from project activities. Contact utilities to confirm locations, as necessary.

Hazard	Task Number	Hazard Control Measures
		Other:
Weather Extremes	1, 2	Potential hazards: lightning, high winds, ice Establish site-specific contingencies for severe weather situations. Provide for frequent weather broadcasts. Weatherize safety gear, as necessary (e.g., ensure eye wash units cannot freeze). Identify special PPE (Section 7) needs. Discontinue work during severe weather Other:
Other: Active Roadways	1, 2	Some of the off-site monitoring wells are in roadways Wear high visibility clothing and set up safety cones

6.2 CHEMICAL HAZARD EVALUATION AND CONTROL

6.2.1 Chemical Hazard Evaluation

Potential chemical hazards are described by task number in Table 6-1. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

TABLE 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
All	1,1,1-Trichloroethane	350 ppm	350 ppm	350 ppm	Y	Inh, Ing, Eye, Skin	Irritation of eyes/skin, headache, weakness, exhaustion, CNS depression, poor equilibrium, cardiac arrhythmia	Sweet odor	105%	11.3
All	1,1-Dichloroethane	100 ppm	100 ppm	100 ppm	Y	Inh, Ing, Eye, Skin	Skin irritation; CNS depression, dizziness, drowsiness, dullness, unconsciousness, nausea; liver, kidney, lung damage	Colorless, oily liquid with a chloroform-like odor		11.06
All	1,2-Dichlorobenzene	50 ppm	50 ppm	25 ppm	Y	Inh, Ing, Eye, Skin	Irritation of eyes, nose; cough, sore throat; dizziness, fatigue, headache, nausea; unconsciousness; liver, kidney damage; skin blisters	.7 ppm Colorless to pale yellow liquid with a pleasant, aromatic odor	50%	9.06
All	1,2-Dichloroethane	100 ppm	1 ppm	10 ppm	Y	Inh, Ing, Eye, Skin	Skin irritation, CNS depression, drowsiness,	Colorless liquid with a pleasant odor like chloroform	80%	11.05
All	2-Butanone	200 ppm	200 ppm	200 ppm	Y	Inh, Ing, Eye, Skin	Eye, nose skin irritation; headache, dizziness; nausea, vomiting; weakness, fatigue, reduced coordination, sleep disturbances; numbness in hands and feet, arms and legs; heaviness in chest; arrhythmia; fainting, unconsciousness	Colorless liquid with a moderately sharp, fragrant, mint or acetone-like odor	80%	9.54
All	Acetone	750 ppm	250 ppm	1000 ppm	Y	Inh, Ing, Eye, Skin	Irritation of eyes, nose, throat; sore throat, cough; headache, dizziness, drowsiness, confusion, CNS depression, unconsciousness; eye redness, pain, blurred vision, dermatitis	Colorless liquid with a fragrant, mint or acetone-like odor	60%	9.69

TABLE 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
All	Benzene	1 ppm	0.1 ppm	0.5 ppm	Y	Inh, Ing, Eye, Skin	Eye, nose, respiratory system irritation; impairment of hearing; CNS disturbances; giddiness; headache; nausea; staggered gait; fatigue; anorexia; lassitude; seizures; unconsciousness; dermatitis; anemia, leukopenia, thrombocytopenia, pancytopenia, aplastic anemia, infection or hemorrhage secondary to bone marrow depression; cardiac sensitization, dyspnea and tachycardia	5 ppm Colorless to light yellow liquid with an aromatic odor	150%	9.24
All	Chlorobenzene	75 ppm	75 ppm	10 ppm	Y	Inh, Ing, Eye, Skin	Skin, eye, nose irritation, headache; nausea; drowsiness, incoordination, unconsciousness	.21 ppm Colorless liquid with an almond-like odor	200%	9.07
All	Chloroethane, aka Ethyl chloride	1000 ppm		1000 ppm	Y	Inh, Ing, Eye, Skin	Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	Colorless gas or liquid with a pungent, ether-like odor		10.97
All	Cis-1,2-Dichloroethene	200 ppm	200 ppm		Y	Inh, Ing, Eye, Skin	Irritation eyes, respiratory system; central nervous system depression	Colorless liquid with a slightly acrid, chloroform-like odor		9.65
All	Ethyl benzene	100 ppm	100 ppm	100 ppm	Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	colorless, flammable liquid that smells like gasoline.	55%	8.76
All	Isopropylbenzene, aka Cumene, Isopropyl benzene, 2-Phenyl propane	50 ppm	50 ppm		Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Colorless liquid with a sharp, penetrating, aromatic odor.	96%	8.75
All	Methyl tert-Butyl Ether	N/A						tastes and/or smells like turpentine	NA	NA

TABLE 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
All	Methylene Chloride	25 ppm	***	50 ppm	Y	Inh, Ing, Eye, Skin	Irritation of the eyes, skin, throat, dizziness, headache, nausea, and difficulty breathing	Colorless liquid with a mild sweet odor	100	11.32
All	Styrene, aka Ethenyl benzene, Phenylethylene, Styrene monomer, Styrol, Vinyl benzene	50 ppm	50 ppm	50 ppm	Y	Inh, Ing, Eye, Skin	Irritation eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	148 ppm Colorless to yellow, oily liquid with a sweet, floral odor.	80%	8.40
All	Tetrachloroethene (PCE)	100 ppm	0.4 ppm	25 ppm	Y	Inh, Ing, Eye, Skin	Irritation of the eyes, skin, throat, dizziness, headache, nausea, and difficulty breathing	5 ppm Odor like ether or chloroform	70%	9.32
All	Toluene	100 ppm	100 ppm	50 ppm	Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, nose, throat; choke, paroxysmal cough; chest pain, retrosternal (occurring behind the sternum) soreness; nausea, vomiting, abdominal pain; bronchitis, bronchospasm, pulmonary edema; dyspnea (breathing difficulty), asthma; conjunctivitis, lacrimation (discharge of tears); dermatitis, skin sensitization; [potential occupational carcinogen]	1.6 ppm Colorless to pale-yellow solid or liquid (above 71°F) with a sharp, pungent odor.	100%	?
All	Xylene	100 ppm	100 ppm	100 ppm	Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	20 ppm Colorless liquid with an aromatic odor.	111%	8.56

TABLE 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
All	Trans-1,2-Dichloroethene	200 ppm	200 ppm	200 ppm	Y	Inh, Ing, Eye, Skin	Irritation eyes, respiratory system; central nervous system depression	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.	36-39%	9.65
All	Trichloroethylene	100 ppm	25 ppm	50 ppm	Y	Inh, Ing, Eye, Skin	Irritation of eyes/nose/throat, vomiting, difficulty breathing	50 ppm Colorless liquid (unless dyed blue) with a chloroform-like odor.	70%	9.45
All	Vinyl Chloride	1 ppm	*	1 ppm	Y	Inh, Ing, Eye, Skin	Irritation of the eyes, skin, throat, dizziness, headache, nausea, and difficulty breathing	Colorless gas or liquid with sweet odor	35%	10.00
All	2,4-Dimethylphenol	TLV not established.			Y	Inh, Ing, Eye, Skin	Burning sensation, Cough, Sore throat, Shortness of breath, abdominal pain. Nausea. Vomiting. Shock or collapse.	Yellow to brown liquid, colorless cyrstals	NA	NA
All	4-Chloroaniline	TLV not established.			Y	Very toxic if inhaled, swallowed or absorbed through the skin		white or pale yellow solid	NA	NA
All	Biphenyl	1 ppm	1 ppm		Y	Inh, Ing, Eye, Skin	Irritation eyes, nose, skin; nausea	Colorless to straw-colored liquid or solid (below 54°F) with a disagreeable, aromatic odor	239%	
All	Bis (2-Chloroethyl) Ether	15 ppm	5 ppm		Y	Inh, Ing, Eye, Skin	Irritation nose, throat, respiratory system; lacrimation (discharge of tears); cough; nausea, vomiting; in animals: pulmonary edema; liver damage	Colorless liquid with a chlorinated solvent-like odor	131%	?

TABLE 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
All	Diethyl phthalate	none	5 mg/m^3		Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, nose, throat; headache, dizziness, nausea; lacrimation (discharge of tears); possible polyneuropathy, vestibular dysfunc; pain, numbness, lassitude (weakness, exhaustion), spasms in arms & legs; in animals: reproductive effects	Colorless to water-white, oily liquid with a very slight, aromatic odor	322%	
All	Napthalene	10 ppm	10 ppm	10 ppm	Y	Inh, Ing, Eye, Skin	fatigue, lack of appetite, restlessness, and pale skin	3 ppm white solid or powder that is insoluble in water, with a strong, mothball odor	48%	8.12
All	Phenol	5 ppm	5 ppm	5 ppm	Y	Inh, Ing, Eye, Skin	Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching	.05 ppm Colorless to light-pink, crystalline solid with a sweet, acrid odor	54%	8.50
All	4,4'-DDE	0.003 mg/m^3 [skin]			Y	Inh, Ing, Eye, Skin	Hematuria (blood in the urine), cyanosis, nausea, methemoglobinemia, kidney irritation	Tan-colored pellets or flakes with a faint, amine-like odor	NA	NA
All	Aroclor 1242, aka PCB, Polychlorinated biphenyl	1 mg/m^3 [skin	0.001 mg/m^3	1 mg/m^3 [skin	Y	Inh, Ing, Eye, Skin	Irritation eyes; chloracne; liver damage; reproductive effects	Colorless to light-colored, viscous liquid with a mild, hydrocarbon odor	NA	NA
All	Gamma-Chlordane	0.5 mg/m^3 [skin]	0.5 mg/m^3 [skin]	0.5 mg/m^3 [skin]	Y	Inh, Ing, Eye, Skin	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria; in animals: lung, liver, kidney damage	Amber-colored, viscous liquid with a pungent, chlorine-like odor. [insecticide]		

TABLE 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
All	Heptachlor epoxide	0.5 mg/m^3 air for 8 hour shifts			Y	Inh, Ing, Eye, Skin	Liver damage, excitability, and decreases in fertility	Pure heptachlor is a white powder that smells like camphor (mothballs). The less pure grade is tan.	NA	NA
All	Antimony	0.5 mg/m^3	0.5 mg/m^3		Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder.	NA	NA
All	Barium	0.5 mg/m^3	0.5 mg/m^3		Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia	White, odorless solid.	NA	?
All	Chromium	0.5 mg/m^3	0.5 mg/m^3		Y	Inh, Ing, Eye, Skin	Irritation eyes; sensitization dermatitis	Appearance and odor vary depending upon the specific compound	NA	NA
All	Iron	none	1 mg/m^3		Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting; possible liver damage	Appearance and odor vary depending upon the specific soluble iron salt.	NA	NA
All	Magnesium	15 mg/m^3			Y	Inh, Eye, Skin	Irritation eyes, nose; metal fume fever: cough, chest pain, flu-like fever	Finely divided white particulate dispersed in air.	NA	NA

TABLE 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
All	Manganese	5 mg/m^3	1 mg/m^3			Inh, Ing	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	A lustrous, brittle, silvery solid.	NA	NA
All	Nickel	1 mg/m^3	0.015 mg/m^3		Y	Inh, Ing, Eye, Skin	Sensitization dermatitis, allergic asthma, pneumonitis	Metal: Lustrous, silvery, odorless solid.	NA	NA
All	Sodium	none	TWA 5 mg/m^3		Y	Inh, Ing, Eye, Skin	Irritation eyes, skin, mucous membrane	White crystals or powder with a slight odor of sulfur dioxide.	NA	NA
All	Thallium	0.1 mg/m^3 [skin]	0.1 mg/m^3 [skin]		Y	Inh, Ing, Eye, Skin	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Appearance and odor vary depending upon the specific soluble thallium compound	NA	NA
All	Mercury	0.1 mg/m^3	Hg Vapor: TWA 0.05 mg/m^3 [skin] Other: C 0.1 mg/m^3 [skin]		Y	Inh, Ing, Eye, Skin	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Metal: Silver-white, heavy, odorless liquid. Other Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls	NA	?

* - Potential occupational carcinogen – NIOSH 2004 ** - Lowest Feasible concentration – NIOSH 1992 *** - Lowest Feasible concentration - NIOSH 1999

6.2.2 Chemical Hazard Control

An appropriate combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below published exposure levels (see Section 6.2.1).

Applicable Engineering/Administrative Control Measures: None.

PPE: See Section 7.

6.3 RADIOLOGICAL HAZARD EVALUATION AND CONTROL

6.3.1 Radiological Hazard Evaluation

Potential radiological hazards are described in Table 6-2 by task number. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Table 6-2 Potential Radiological Hazards

Task Number	Radionuclide	DAC (μCi/ml)	Route(s) of Exposure	Major Radiation(s)	Energy(s) (MeV)	Half-Life

6.3.2 Radiological Hazard Control

Engineering/administrative controls and work practices shall be instituted to reduce and maintain employee exposures to a level at or below the permissible exposure/dose limits (see Sections 4.2.3 and 6.3.1). Whenever engineering/administrative controls and work practices are not feasible or effective, any reasonable combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below permissible exposure/dose limits.

Applicable Engineering/Administrative Control Measures:

PPE: See Section 7.

7. LEVEL OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

7.1 LEVEL OF PROTECTION

The following levels of protection (LOPs) have been selected for each work task based on an evaluation of the potential or known hazards, the routes of potential hazard, and the performance specifications of the PPE (see Table 7-1). On-site monitoring results and other information obtained from on-site activities will be used to modify these LOPs and the PPE, as necessary, to ensure sufficient personnel protection. The authorized LOP and PPE shall only be changed with the approval of the regional safety coordinator or designee. Level A is not included below because Level A activities, which are performed infrequently, will require special planning and addenda to this SHASP.

Table 7-1 Levels of Protection

Task Number	B	C	D	Modifications Allowed
All		(X)	X	hand and splash protection when sampling

Note: Use "X" for initial levels of protection. Use "(X)" to indicate levels of protection that may be used as site conditions warrant.

7.2 PERSONAL PROTECTIVE EQUIPMENT

The PPE selected for each task is indicated below. PPE program complies with 29 CFR 1910.120 and 29 CFR 1910 Subpart I and is described in detail in the CHSP. Refer to 29 CFR 1910 for the minimum PPE required for each LOP.

Table 7-2 Personal Protective Equipment

PPE	LOP					
	C	D				
Full-face APR	(X)					
PAPR						
Cartridges:						
P100						
GMC-P100						
GME-P100	(X)					
Other:						
Positive-pressure, full-face SCBA						
Spare air tanks (Grade D air)						
Positive-pressure, full-face, supplied-air system						
Cascade system (Grade D air)						
Manifold system						
5-Minute escape mask						
Safety glasses		X				
Monogoggles						
Coveralls/clothing	X	X				
Protective clothing:						
Tyvek						
Saranex						
Other:						
Splash apron	X when sampling	X when sampling				
Inner gloves:						
Cotton						
Nitrile	X	X				
Latex						
Other:						
Outer gloves:						
Viton						
Rubber						
Neoprene						
Nitrile	X	X				
Other:						
Work gloves						
Safety boots (as per ANSI Z41)	X	X				
Neoprene safety boots (as per ANSI Z41)						
Boot covers (type: _____)						
Hearing protection (type: minimum ear plugs)						
Hard hat						
Face shield		X when sampling				
Other:						
Other:						

8. HEALTH AND SAFETY MONITORING

Health and safety monitoring will be conducted to ensure proper selection of engineering/administrative controls, work practices, and/or PPE so that employees are not exposed to hazardous substances at levels that exceed permissible exposure/dose limits or published exposure levels. Health and safety monitoring will be conducted using the instruments, frequency, and action levels described in Table 8-1. Health and safety monitoring instruments shall have been appropriately calibrated and/or performance-checked prior to use.

TABLE 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[a]	
☐ PID (e.g., RAE mini RAE) ☐ FID (e.g., OVA 128-) ☒ TVA 1000	1, 2	All of concern (see table 6-1)	Between the hole and the breathing zone	Continuous when workers present at hole	**Unknown Vapors** Background to 1 ppm above background: Level D 1 to 5 ppm above background: Level C 5 to 500 ppm above background: Level B >500 ppm above background: Level A	**Contaminant-Specific**
Oxygen Meter/Explosimeter	1, 2	Highly flammable contaminants such as acetone	At the borehole	Every 10 minutes	**Oxygen** <19.5% or >22.0%: Evacuate area; eliminate ignition sources; reassess conditions. 19.5 to 22.0%: Continue work in accordance with action levels for other instruments.	**Explosivity** ≤10% LEL: Continue work in accordance with action levels for other instruments; monitor continuously for combustible atmospheres. >10% LEL: Evacuate area; eliminate ignition sources; reassess conditions.
Other:						
Other:						

[a] Unless stated otherwise, airborne contaminant concentrations are measured as a time-weighted average in the worker's breathing zone. Acceptable concentrations for known airborne contaminants will be determined based on OSHA/NIOSH/ACGIH and/or NRC exposure limits. As a guideline, 1/2 the PEL/REL/TLV, whichever is lower should be used.

9. DECONTAMINATION PROCEDURES

All equipment, materials, and personnel will be evaluated for contamination upon leaving the exclusion area. Equipment and materials will be decontaminated and/or disposed and personnel will be decontaminated, as necessary. Decontamination will be performed in the contamination reduction area or any designated area such that the exposure of uncontaminated employees, equipment, and materials will be minimized. Specific procedures are described below.

Equipment/Material Decontamination Procedures (specified by work plan): High-pressure steam wash for large equipment, for down-hole tooling, gross material removal, then scrub brush with TSP solution, and deionized water for rinse, air dry.

Ventilation: All decontamination procedures will be conducted in a well-ventilated area.

Personnel Decontamination Procedures: Gross material removal, scan with site instrumentation, remove and double bag, dispose of as appropriate based on scanning results.

PPE Requirements for Personnel Performing Decontamination: Level D with splash protection and gloves.

Personnel Decontamination in General: Following appropriate decontamination procedures, all field personnel will wash their hands and face with soap and potable water. Personnel should shower at the end of each work shift.

Disposition of Disposable PPE: Disposable PPE must be rendered unusable and disposed of as indicated in the work plan.

Disposition of Decontamination Wastes (e.g., dry wastes, decontamination fluids): As indicated in the work plan

10. EMERGENCY RESPONSE

This section contains additional information pertaining to on-site emergency response and does not duplicate pertinent emergency response information contained in earlier sections of this plan (e.g., site layout, monitoring equipment, etc.). Emergency response procedures will be rehearsed regularly, as applicable, during project activities.

10.1 EMERGENCY RESPONSIBILITIES

All Personnel: All personnel shall be alert to the possibility of an on-site emergency; report potential or actual emergency situations to the team leader and SSO; and notify appropriate emergency resources, as necessary.

Team Leader: The team leader will determine the emergency actions to be performed by field personnel and will direct these actions. The team leader also will ensure that applicable incidents are reported to appropriate Consultant personnel and client project personnel and government agencies.

SSO: The SSO will recommend health/safety and protective measures appropriate to the emergency.

Recommendations will be made with the concurrence of the regional safety coordinator as necessary.

Other: _____

_____

10.2 LOCAL AND SITE RESOURCES (including phone numbers)

Ambulance: **911**

Hospital: North Central Bronx Hospital, 3424 Kossuth Ave, Bronx, NY 10467-2410, Telephone: 718-519-5000

Directions to Hospital (map attached at the end of this plan): go south on Pear Tree Ave. less than 0.1 miles, turn right onto Hollers Ave. Go west on Hollers Ave for less than 0.1 miles, turn right onto Conner St. Go north on Conner St for 0.1 miles, turn left onto US-1 (Boston Rd). Go west on US-1 1.6 miles, turn right onto E Gun Hill Rd. Go north on E Gun Hill Rd for 1.4 miles, turn left onto Bainbridge Ave. Go west on Bainbridge Ave for 0.1 miles, turn right onto E 210th St. Go north on E 210th St for 0.1 miles, turn right onto Kossuth Ave. Go east on Kossuth Ave. for less than 0.1 miles you are at 3424 Kossuth Ave.

Poison Control: _____

Police Department: **9-1-1**

-

Fire Department: **9-1-1**

Client Contact: Mike Mason, NYSDEC – 518-402-9814

Site Contact: None

On-Site Telephone Number: Field to be equipped with a cellular telephone

Cellular Telephone Number: TBD

Radios Available: TBD

Other: _____

10.3 CONSULTANT'S EMERGENCY CONTACTS

Emergency Operations Center (24 Hours):	TBD
Health and Safety Director, [name]:	TBD (office) TBD (home)
Regional Office Contact: [name]	TBD (office) TBD (home)
Other: [name]	TBD (office)

10.4 OTHER EMERGENCY RESPONSE PROCEDURES

On-Site Evacuation Signal/Alarm (must be audible and perceptible above ambient noise and light levels): steady 15 seconds or more sounding of vehicle horn

On-Site Assembly Area: at entrance gate on Pear Tree Avenue

Emergency Egress Route to Get Off Site: through entrance gate at Pear Tree Avenue side of site

_____

Off-Site Assembly Area: McDonald's parking lot at corner of Boston Road and Conner Street

Preferred Means of Reporting Emergencies: Verbal communication to Task Leader or SSO who will then make all other necessary emergency notifications depending upon the circumstances.

Site Security and Control: In an emergency situation, personnel will attempt to secure the affected area and control site access.

Spill Control Procedures: If on site, mark the area as off limits until monitoring indicates that volatile hazards are not present. Then collect contaminated surface gravel, geotextile, and soil, then place in waste drums. Replace soil, geotextile and surface gravel in-kind.

Emergency Decontamination Procedures: If emergency is life threatening, remove gross material and PPE only, then transport to hospital

PPE: Personnel will don appropriate PPE when responding to an emergency situation. The SSO and Section 7 of this plan will provide guidance regarding appropriate PPE.

Emergency Equipment: Appropriate emergency equipment is listed in Attachment 1. Adequate supplies of this equipment shall be maintained in the support area or other approved work location.

Incident Reporting Procedures: Report to PM who will then report the incident to H&S Director.

ATTACHMENT 1

EQUIPMENT/SUPPLIES CHECKLIST

	No.
INSTRUMENTATION	
TVA 1000	1
FID	
O_2/explosimeter w/cal. Kit	1
Photovac tip	
PID (probe: _____eV)	
Magnetometer	
Pipe locator	
Weather station	
Draeger tube kit (tubes: _____)	
Brunton compass	
Real-time cyanide monitor	
Real-time H_2S monitor	
Heat stress monitor	
Noise equipment	
Personal sampling pumps and supplies	
MiniRam dust monitor	
Mercury monitor	
Spare batteries (type: _____)	
RADIATION EQUIPMENT/SUPPLIES	
Documentation forms	
Portable ratemeter	
Scaler/ratemeter	
1" NaI gamma probe	
2" NaI gamma probe	
ZnS alpha probe	
GM pancake probe	
Tungsten-shielded GM probe	
Micro R meter	
Ion chamber	
Alert monitor	
Pocket dosimeter	
Dosimeter charger	
Radiation warning tape	

	No.
Radiation decon supplies	
Spare batteries (type: _____)	
SAMPLING EQUIPMENT	
8-oz. bottles	
Half-gallon bottles	
VOA bottles	
String/rope	500ft
Hand bailers	
Thieving rods with bulbs	
Spoons	
Knives	
Filter paper	
Bottle labels	105
MISCELLANEOUS	
Pump	1
Surveyor's tape	
100' Fiberglass tape	1
300' Nylon rope	
Nylon string	
Surveying flags	
Camera	1
Film	
Bung wrench	
Soil auger	
Pick	
Shovel	1
Catalytic heater	
Propane gas	
Banner tape	
Surveying level and rod	1
Chaining pins and ring	
Logbooks (__1___ large, _____ small)	

	No.
Required MSDSs	
Intrinsically safe flashlight	
Potable water	5 gallons
Gatorade or equivalent	
Tables	
Chairs	
Weather radio	
Two-way radios	
Binoculars	
Megaphone	
Cooling vest	
EMERGENCY EQUIPMENT	
First aid kit	
Stretcher	
Portable eye wash	
Blood pressure monitor	
Fire blanket	
Fire extinguisher	
Thermometer (medical)	
Spill kit	
DECONTAMINATION EQUIPMENT	
Wash tubs	2
Buckets	
Scrub brushes	2
Pressurized sprayer	
Spray bottle	2
Detergent (type: TSP_____)	1
Solvent (type: _____)	
Plastic sheeting	
Tarps and poles	1 tarp
Trash bags	30
Trash cans	
Masking tape	

	No.
Duct tape	
Paper towels	3 rolls
Face mask	
Face mask sanitizer	
Step ladders	
Distilled water	
Deionized water	3 gallons
SHIPPING EQUIPMENT	
Coolers	4
Paint cans with lids, 7 clips each	24
Vermiculite	
Shipping labels	4
DOT labels:	
"Up"	8
"Danger"	
"Inside Container Complies ..."	
Hazard Group (9)	4
Strapping tape	2 roles
Baggies	150
Custody seals	150
Chain-of-custody forms	10
Express shipment forms	
Clear packing tape	2 roles
Permanent markers	6

ATTACHMENT 2
SITE PLAN

Insert Site Map Here.

APPENDIX E – MONITORING WELL BORING AND CONSTRUCTION LOGS

TAMS CONSULTANTS, INC **BORING LOG** **Boring No.: B-2(MW-2)**

PROJECT: Hexagon Laboratories	CONTRACTOR: Aquifer Drilling & Testing	PAGE 1 OF 3
PROJECT NO.: 5851-300	LOCATION: Bronx, New York	DATE: 11/19/97
SURFACE ELEVATION:	DATUM: DRILLER:	TAMS REP.: P. Kareth

WATER LEVELS				DRILLING AND SAMPLING				
DATE	TIME	DEPTH	CASING		CASING	SAMPLER	CORE	TUBE
				TYPE	Steel	split spoon		
				I.D.	6-inch	1 3/8 inch		
				WT./Fall	--	140 lbs.		

Depth (ft)	Sample Number & Time	Blows per/6"	Recovery (feet)	HNu Readings (ppm)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
-- 1					Blacktop
					For soil descriptions 0 ft to 16.5 ft, see boring log B-1
-- 2	----------	----------	----------	----------	
					Augered to 17 ft with 6 1/4-inch HSAs
-- 3					End of day 11/19/97
-- 4	----------	----------	----------	----------	Start of day 11/20/97
					Ream borehole with 8 1/4-inch HSAs to 17 ft
-- 5					
-- 6	----------	----------	----------	----------	
-- 7					
-- 8	----------	----------	----------	----------	
-- 9					
--10	----------	----------	----------	----------	
--11					
--12	----------	----------	----------	----------	
--13					
--14	----------	----------	----------	----------	
--15					
--16	----------	----------	----------	----------	---------- 16 ft ----------
					Top of weathered bedrock, SCHIST
--17					HSAs to 17 ft
					Drill out 17 ft to 21 ft using 7 7/8-inch tricone bit
--18	----------	----------	----------	----------	
--19					
--20	----------	----------	----------	----------	

PROJECT: Hexagon Laboratories

PROJECT NO.: 585-300 PAGE 2 OF 3

Depth (ft)	Sample # & Time	Blows per/6"	Recovery (feet)	HNu (ppm)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
--20					Install 6-inch ID steel casing to 21 ft. Grout casing in place.
					End of day 11/20/97
--21					
					Start of day 11/21/97
--22	R-1				Continue drilling inside the 6-inch casing using a NQ core barrel.
					Start of Day 12/8/97 - Ream borehole from 21 ft to 53 ft using an
--23					air rotary 6-inch percussion bit.
					MANHATTAN SCHIST
--24					7 Pieces: 7, 7, 6, 2, 2, 2½, 21
					Recovery: 47½ inches, 79%
--25					RQD: 41 inches, 68%
					Drilling time: 23 minutes
--26					
--27	R-2				MANHATTAN SCHIST, chlorite noted on some cracks,
					fine sand noted in some cracks.
--28					10 Pieces: 6½, 7½, 2, 10, 5, 11, 8, 2½, 3, 3
					Recovery: 58½ inches, 98%
--29					RQD: 48 inches, 80%
					Drilling time: 30 minutes
--30					
--31					
--32	R-3				MANHATTAN SCHIST
					9 Pieces: 10, 6, 2½, 2½, 3, 3, 19, 9, 9 (last piece broke during
--33					removal, broke into 4 pieces)
					Recovery: 64 inches, 107%
--34					RQD: 53 inches, 88%
					Drilling time: 20 minutes
--35					
--36					
--37	R-4				MANHATTAN SCHIST, biotite content increased significantly
					near the bottom of the core run, 38 - 41 ft very fast drilling,
--38					no recovery for bottom 3 ft of core run.
					3 Pieces: 15, 8, 3
--39					Recovery: 26 inches, 43%
					RQD: 23 inches, 38%
--40					Drilling time: 16 minutes

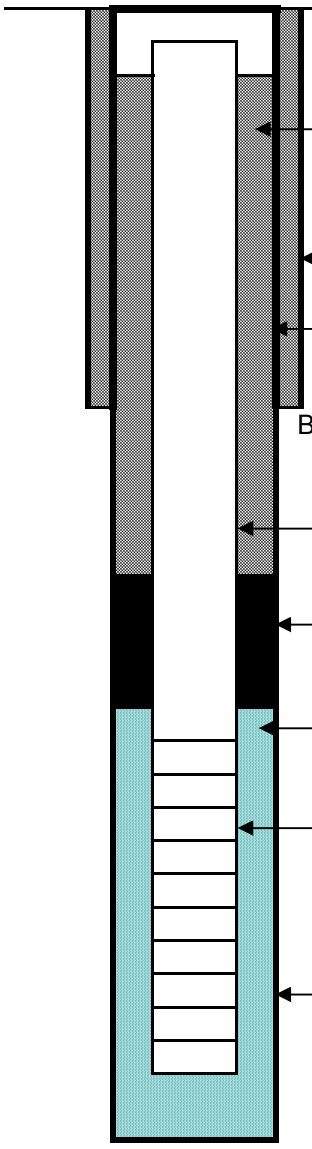
PROJECT: Hexagon Laboratories

PROJECT NO.: 585-300 PAGE 3 OF 3

Depth (ft)	Sample # & Time	Blows per/6"	Recovery (feet)	HNu (ppm)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
-40	R-4 (Cont.)				
-41					
-42	R-5				MANHATTAN SCHIST - Very soft from 41 - 43 ft, uneven drilling for the rest of the core run. Driller noted a significant amount of formation water from 40 - 45 ft during air hammer reaming, several clay coated fractures noted, condition of core is poor.
-43					
-44					6 Pieces: rubble, 4, 5, 5, 5, 4, 4
-45					Recovery: 27 inches, 45%
-46					RQD: 27 inches, 45%
-47	R-6				Drilling time: 26 minutes
-48					MANHATTAN SCHIST - Several rubble zones recovered, drilling advance slowed below 49 ft, driller noted less formation water below 49 ft during air hammer reaming.
-49					6 Pieces: rubble, 3, 3, 5, rubble, 2½, 3, 3, rubble
-50					Recovery: 19½ inches, 33%
-51					RQD: 5 inches, 8%
-52					Drilling time: 25 minutes
-53					End of Day 11/21/97
-54					End of Boring at 53.0 Ft
-55					Install monitoring well MW-2 on 12/8/97
-56					
-57					
-58					
-59					
-60					

TAMS CONSULTANTS, Inc. **Well No. MW-2**

Project: Hexagon Laboratories	Location: Bronx, New York	Page 1 of 1		
Project No.: 5851-300	Contractor: Aquifer Drilling & Testing	Water Levels		
Surface Elevation: 27.36 ft	Driller: Jerry Heller	Date	Time	Depth
Top of PVC	Well Permit No.:			
Casing Elevation: 27.06 ft	TAMS Rep.: Paul Kareth			
Datum: NGVD	Date of Completion: 12/8/97			



Concrete Seal, from GS ft. to -0.5 ft.

Cement-bentonite grout from -0.5 ft. to -35.5 ft.

Borehole diameter: 8 inches

Steel casing from -0.5 ft. to -35.5 ft.

Bottom of 8-inch borehole at 21.0 ft.

Riser Pipe from -0.4 ft. to -40.0 ft.

Bentonite seal from -35.5 ft. to -37.5 ft.

Filter pack from -37.5 ft. to -53.0 ft.
Sand Size #2

Well screen from -40.0 ft. to -50.0 ft.
Diameter 2 inches
Slot size 0.01 inches
Type PVC

Borehole diameter: 6 inches

Bottom Cap at 50.0 ft.

Bottom of Borehole at 53.0 ft.

Note: All measurements based on ground surface at 0 feet. (+) above grade. (-) below grade.

(NOT TO SCALE)

HEXAGON SITE
MONITORING WELL DEVELOPMENT DATA SHEET

Monitoring well number: MW-2
date: 12/15/97 Time: 8:15
water level: 10.56 ft Total depth of well: 50.5 ft
One casing volume: 6.53 gallons

Time	Gallons Purged	pH	Conductivity Value	scale	Temp	NTU		Comments
8:27	6	6.81	110	10x	14	59.2		
8:35	12	6.77	82	10x	13	96.9		
8:47	19	6.74	70	10x	13	>200		
9:00	26	6.73	80	10x	13	>200		
9:15	31	6.71	80	10x	13	>200		well went dry
								pumping depth
								at 20.4 ft
9:40								pump on
9:47	36	6.74	70	10x	13	>200		well went dry after
								5 minutes
13:40								WL - 11.26
13:41								pump on
13:45	6	6.81	82	10x	11	>200		
13:50	13	6.83	85	10x	12	>200		
13:56	27	6.79	82	10x	11	>200		
14:08	36	6.83	80	10x	10	>200		
14:15								WL - 27.8 ft
14:16	42	6.81	81	10x	9	>200		
14:26	50	6.77	81	10x	10	>200		
14:36	56	6.80	70	10x	11	>200		
14:40	58							end purging
	total of 96 gallons removed							

Type of pump: 2 stage Whale pump

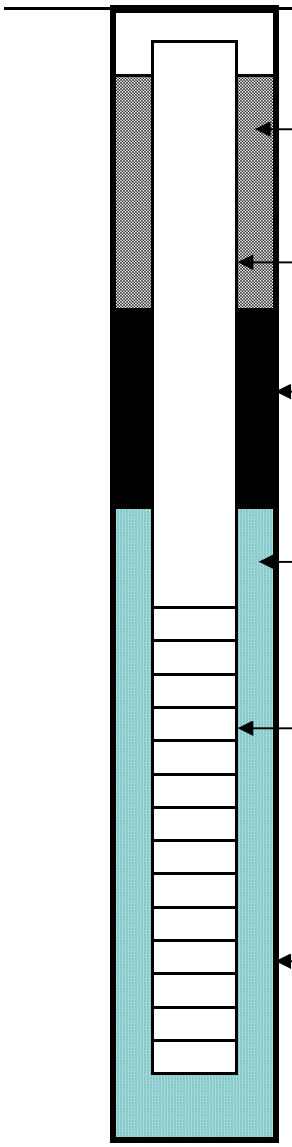
TAMS CONSULTANTS, INC **BORING LOG** **Boring No.: B-6 (MW-6)**

PROJECT: Hexagon Laboratories				CONTRACTOR: Aquifer Drilling & Testing			PAGE 1 OF 1	
PROJECT NO.: 5851-300				LOCATION: Bronx, New York			DATE: 1/16/98	
SURFACE ELEVATION:				DATUM: DRILLER: Steve Wolf			TAMS REP.: C. Purkiss	
WATER LEVELS				DRILLING AND SAMPLING				
DATE	TIME	DEPTH	CASING		CASING	SAMPLER	CORE	TUBE
				TYPE		split spoon	PQ	
				I.D.		2 1/2-inch	2 1/2-inch	
				WT./Fall		140 lbs.		

Depth (ft)	Sample Number & Time	Blows per/6"	Recovery (feet)	HNu Readings (ppm)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
					6-inch thick concrete sidewalk, 6-inch thick stone base
-- 1	S-1	18 - 56	0.9	0.2	SP/SM - Brown gravelly coarse to fine SAND, some silt, trace clay, dry.
-- 2					**HXB6S1 (TCL/TAL,TOC, GS)**
-- 3	Run 1				MANHATTAN SCHIST
-- 4					11 Pieces: 2, 3, 4, 4, 8, 1, 3, 4½, 4, 5½, 4
-- 5					Recovery: 43 inches, 72%
-- 6					RQD: 34 inches, 57%
-- 7					First water noted at 6.5 to 7 ft
-- 8					Ream borehole with 6-inch percussion air rotary bit to 7 ft, continue borehole advance to 15.5 ft with percussion bit.
-- 9					
--10					
--11					
--12					
--13					
--14					
--15					
--16					End of Boring at 15.5 Ft.
--17					
--18					
--19					
--20					

TAMS CONSULTANTS, Inc. **Well No. MW-6**

Project: Hexagon Laboratories	Location: Bronx, New York	Page 1 of 1		
Project No.: 5851-300	Contractor: Aquifer Drilling & Testing	Water Levels		
Surface Elevation: 34.15 ft	Driller: Steve Wolf	Date	Time	Depth
Top of PVC	Well Permit No.:			
Casing Elevation: 33.76 ft	TAMS Rep.: Chris Purkiss			
Datum: NGVD	Date of Completion: 1/16/98			



Concrete Seal, from GS ft. to 0.5 ft.

Cement-bentonite grout from -- ft. to -- ft.

Riser Pipe from 0.5 ft. to 5.0 ft.

Bentonite seal from 1.0 ft. to 3.0 ft.

Filter pack from 3.0 ft. to 15.5 ft.

Sand Size #1 Morie

Well screen from 5.0 ft. to 15.0 ft.

Diameter 2 inches
Slot size 0.01 inches
Type PVC

Borehole diameter: 6 inches

Bottom Cap at 15.0 ft.

Bottom of Borehole at 15.5 ft.

Note: All measurements based on ground surface at 0 feet. (+) above grade. (-) below grade.

(NOT TO SCALE)

HEXAGON SITE
MONITORING WELL DEVELOPMENT DATA SHEET

Monitoring well number: MW-6
date: 1/21/98 Time: 7:45
water level: 6.30 ft Total depth of well: 15.0 ft
One casing volume: 1.58 gallons

Time	Gallons Purged	pH	Conductivity Value	scale	Temp	NTU		Comments
8:27								pump on
8:29	1	7	68	10x	5	6.2		
8:37	8	7.56	355	1x	2	1.8		
8:43	13	7.74	65	10x	3			
8:50	26	7.77	65	10x	3	0.98		
8:56	37	7.78	65	10x	3	122		lifted pump and
								broke suction,
								cloudy
9:05	54	7.8	60	10x	3	4.1		cleared quickly
9:13	69	7.8	62	10x	3.5	3.68		
9:26	94	7.83	435	1x	3	1.6		
9:34	106	7.82	60	10x	3	1.8		
9:38								pump off
	total of 108 gallons removed							

Type of pump: 2 stage Whale pump

TAMS CONSULTANTS, INC **BORING LOG** **Boring No.:B-11 (MW-11)**

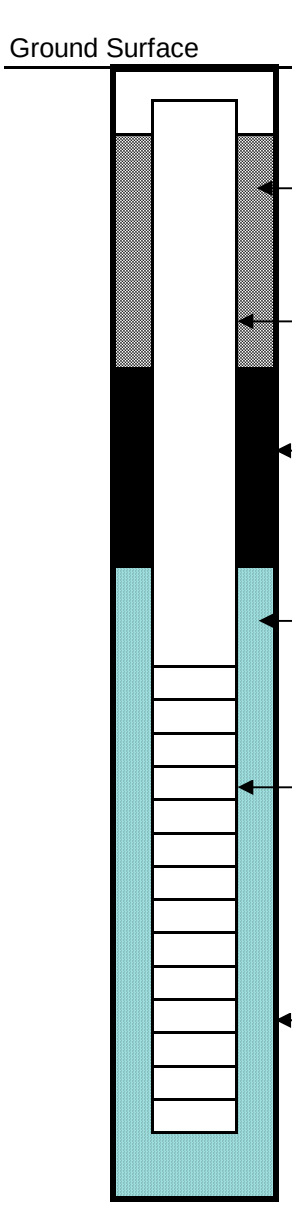
PROJECT: Hexagon Laboratories	CONTRACTOR: Maxim Technologies, Inc.	PAGE 1 OF 1
PROJECT NO.: 5851-400	LOCATION: Bronx, New York	DATE: 6/1/99
SURFACE ELEVATION:	DATUM: DRILLER: Frank Ware	GZA REP.: S. Kline

WATER LEVELS				DRILLING AND SAMPLING				
DATE	TIME	DEPTH	CASING		CASING	SAMPLER	CORE	TUBE
				TYPE		split spoon		
6/8/99	1320	8.98		I.D.		1 3/8 inch		
				WT./Fall		140 lbs.		

Depth (ft)	Sample Number & Time	Blows per/6"	Pen. Recovery (feet)	HNu Readings (ppm)	SAMPLE DESCRIPTION, REMARKS, AND STRATUM CHANGES
-- 1	S-1	23-26	24/8	< 1	SW - Dense brown, well-graded SAND, trace Gravel (FILL).
-- 2	1-3	16-18			
-- 3	S-2	8-24	24/12	< 1	SW - Very dense, brown, well-graded SAND, trace Gravel, trace Silt (FILL), cobbles at ± 4'.
-- 4	3-5	27-50			
-- 5	S-3	33-48	24/6	< 1	SM - Very dense brown, silty SAND, trace roots, changing after 2" to SW - brown well-graded SAND, little Gravel (may be original ground surface at 5-6'), cobbles between ± 7'-8'.
-- 6	5-7	44-44			
-- 7	S-4	33-50	16/NR		Very dense Sandy soil. Lost split-spoon sampler down borehole and could not retreive. Grouted borehole. Moved 10' south and drilled 6" borehole to depth.
-- 8	7-9	100/4"			
-- 9					Bedrock surface at 9.5'
--10					Slightly weathered gray MANHATTAN SCHIST
--11					Drilled to 18' with 5 7/8-inch tricone bit.
--12					For Rock descriptions see boring log B-12.
--13					
--14					
--15					
--16					
--17					Installed monitoring well MW-11 in borehole on 6/1/99.
--18					END OF EXPLORATION AT ± 18 FEET.
--19					
--20					

TAMS CONSULTANTS, Inc. **Well No. MW-11**

Project: Hexagon Laboratories	Location: Bronx, New York	Page 1 of 1		
Project No.: 5851-400	Contractor: Maxim Technologies, Inc.	Water Levels		
Surface Elevation: 21.25	Driller: Frank Ware	Date	Time	Depth
Top of PVC	Well Permit No.:	6/3/99	0900	8.62
Casing Elevation: 20.96	GZA Rep.: Stephen Kline	6/8/99	1320	8.98
Datum:	Date of Completion: 6/1/99			



Flush Mount Protective Cap

Ground Surface

Concrete Seal, from -0.5 ft. to 0.0 ft.

Cement-bentonite grout from -2.0 ft. to -0.5 ft.

Riser Pipe from -6.3 ft. to -0.3 ft.

Bentonite seal from -4.0 ft. to -2.0 ft.

Filter pack from -16.3 ft. to -4.0 ft.

Sand Size 0

Well screen from -16.3 ft. to -6.3 ft.

Diameter 2 inches
Slot size 0.01 inches
Type PVC

Borehole diameter: 6 inches

Bottom Cap at -16.3 ft.

Bottom of Borehole at -18.0 ft.

Note: All measurements based on ground surface at 0 feet. (+) above grade. (-) below grade.

(NOT TO SCALE)

HEXAGON SITE
MONITORING WELL DEVELOPMENT DATA SHEET

Monitoring Well Number: MW-11
Date: 6/3/1999 Time: 0900
Water Level: 8.62 ft Total Depth of Well: 16.25 ft
One Casing Volume: 1.27 gallons

Time	Gallons Purged	pH	Conductivity Value	Conductivity scale	Temp	NTU	DTW	Comments
0932	---						8.62	Pump on
0933	2	6.48	110	x1	17	200+	10.1	Pump off
0945	2.25	6.65	310	x1	17	999+	10.45	Pump on
0950	3	6.7	350	x1	17	999+	11.1	Pump slowed down
0955	4	6.6	350	x1	17	999+	14.1	Pump off
1000							9.71	Recovery
1005	4.25	6.6	60	x10	17	999+	8.6	Pump on
1006	5	6.5	60	x10	17	999+	15.1	
1009	7.5	6.5	65	x10	17	999+	14.75	Pump slowed down
1013	9	6.5	70	x10	18	200+	14.15	Visible clearer
1016	9.5	6.4	70	x10	20	200+	14.15	Visible clearer - pump
								heating up
1018	9.5						14.2	Pump off
1025	9.5						9.84	Recovery - Pump on
1026	10	6.4	90	x10	19	155	NR	
1028	11	6.4	70	x10	19	200+	14.45	
1033	12	6.4	70	x10	19	200+	14.65	Pump off
1045	12	6.4	80	x10	19	200+	9.6	Pump on
1050	14.5	6.4	80	x10	17	200+	15.1	
1055	16	6.4	75	x10	17	200+	14.9	
1104	18.5	6.4	80	x10	20	50	14.6	
1113	21	6.4	80	x10	20	34	14.75	Pump off
1125	21.5	6.4	80	x10	20	60	9.7	Recovery - Pump on
1137	25	6.45	80	x10	20	45	14.45	HNU = ND
1145	30	6.4	80	x10	20	35	14.65	Pump off

Type of pump: grunfos rediflo 2 electrical submersible
NR = Not recorded
DTW = "depth to water" from top of PVC riser (ft)

Borehole Record for MW-15

- Drilling Log
- Narrative Lithologic Description
- Well Development Record
- Well Development -- Parameter Measurements
- Investigation - Derived Waste Inventory Sheet

DRILLING LOG FOR MW-15

Project Name Hexagon Lab

Site Location Bronx, NY

Date Started/Finished 12/7/10 - 01/11/11

Drilling Company Aztech

Driller's Name Marty Harrington

Geologist's Name Megan Horanburg

Geologist's Signature MHoranburg

Rig Type (s) BK66 Longyear

Drilling Method (s) Auger, coring

Bit Size (s) HQ Auger Size (s) 6.25"

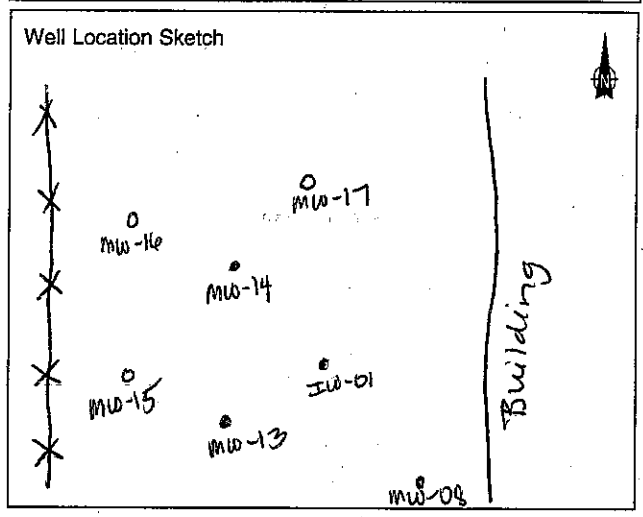
Auger/Split Spoon Refusal

Total Depth of Borehole Is

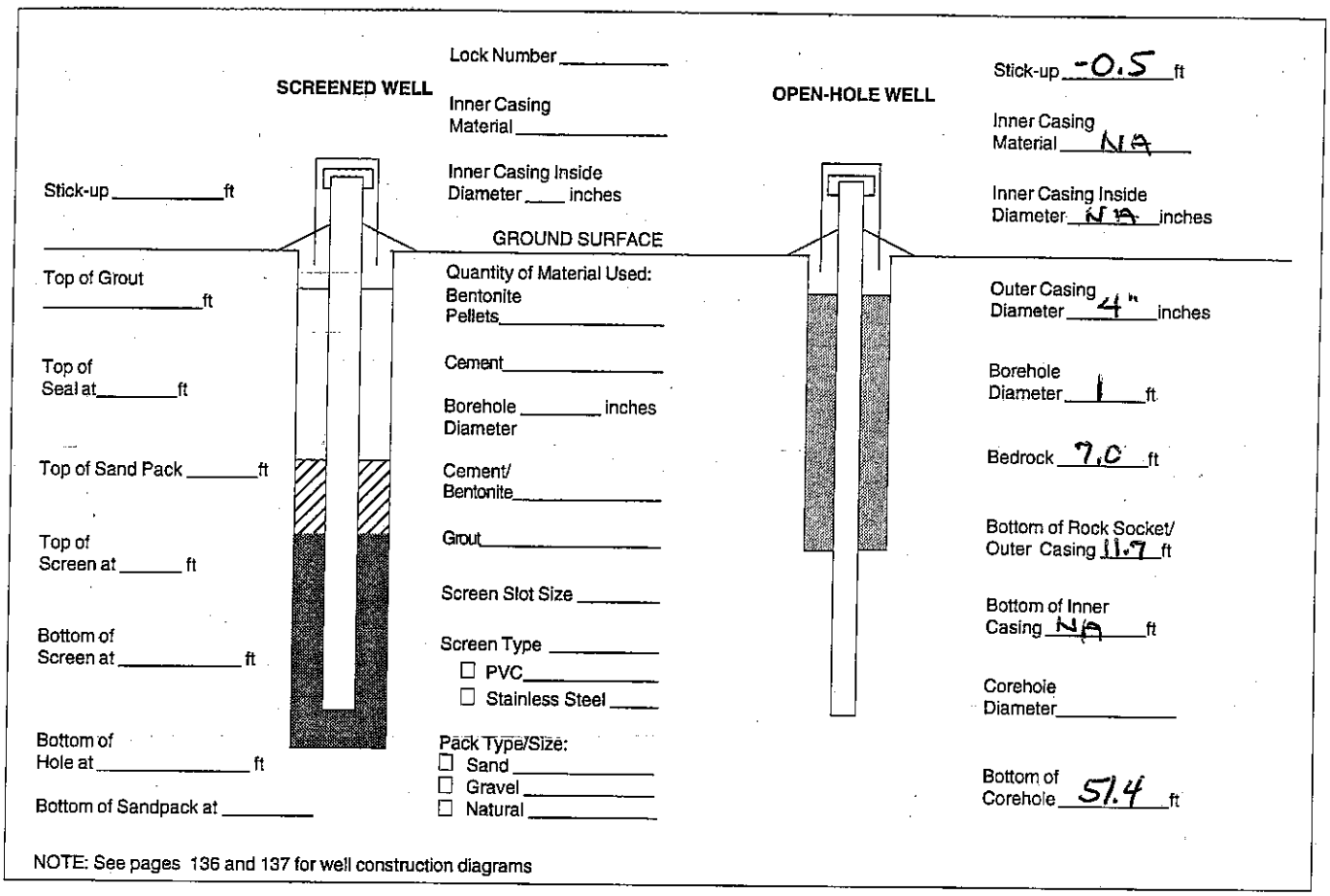
Total Depth of Corehole Is 51'

Water Level (TOIC)		
Date	Time	Level(Feet)

Well Location Sketch



Depth(Feet)	Sample Number	Blows on Sampler	Soil Components Rock Profile CL SL S GR	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
1			GR						0	
2			SW-SM						0	
3									0	
4										
5									0	
6									3	black staining starting about 6' bgs
7			weathered bedrock							
8										set steel casing about 4.5' into weathered bedrock
9										
10										
11										
12				1302	1	95%	88%		0	0 ppb breathing zone
13									0.5	
14										
15				1314					0	0 gal = water loss



NOTE: See pages 136 and 137 for well construction diagrams

Depth-ft.	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content: Dry	Moist	Wet
1	0-1' Gravel (coarse) to cobble, gray	●	○	○
2	1-7' (7.5'?) Brown CMF sand with little silt,	●	○	○
3	little gravel, dry to moist, wet at bottom, black	●	○	○
4	stained sand from about 6-7' bgs based on	●	○	○
5	cuttings	●	○	○
6		○	●	○
7		○	●	○
8	7-11.7' weathered bedrock	○	○	●
9		○	○	○
10		○	○	○
11		○	○	○
12	~~CORE RUN 1: (11.7-16.4')~~	○	○	○
13	Black and white mottled schist, medium hard, porous to pitted,	○	○	○
14	laminated to banded bedding at varying angles, close	○	○	○
15	to moderately close fracturing, slight to moderate weathering	○	○	○

Depth(feet)	Sample Number	Blows on Sampler	Soil Components CL SL S GR	Rock Profile	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
16					1302	1	95%	38%		0	
					1314						
17					1327	2	99%	83%		0.3	0.1 ppb
18											
19											0 gal = water loss
20											
21					1340						
22					1353	3	100%	93%		0.3	0.9 ppb @ top of rod
23											0 ppb = breathing zone
24											0 gal = water loss
25											
26					1410					0.9	
27					1428	4	100%	68%		3.7	39.5 ppb = @ top of rod
28											0.3 ppb = breathing zone
29											10 gal = water loss
30											
31					1444					156	
32					1502	5	63%	46%		1.3	15.1 ppb @ top of rod
33											0 ppb = breathing zone
34	actual recovery line				1519					9.8	0 gal = water loss
35					1527	6	100%	100%		1.0	
36										0.0	
37					[illegible]						9.4 ppb = @ top of rod
38											0 ppb = breathing zone
39					1529						
40					1544	7	100%	72%		1.7	0 gal = water loss
41					1554						
42					1604	8	90%	75%		0.5	@ start run 8, 40 gal H2O have been lost
43											
44											10 gal = water loss
45											

Depth(feet).	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content: Dry	Moist	Wet
16	~~CORE RUN 2: (16.4-21.4')~~	○	○	○
17	Black and white mottled schist, medium hard to hard,			
18	porous to pitted, laminated to banded bedding, very			
19	close to moderately close fracturing, slightly to			
20	moderate weathering.			
21	CORE RUN 3: (21.4-26.4')			
22	Black and white mottled schist, hard, porous to pitted,			
23	laminated to parting bedding at varying angles, close			
24	to moderately close fracturing, slightly to moderate			
25	weathering			
26	CORE RUN 4: (26.4-31.4')			
27	Black and white mottled schist, soft to hard, porous			
28	to pitted, laminated to parting bedding at 20-45°			
29	angles. close fracturing, slightly to high weathering			
30				
31				
32	CORE RUN 5: (31.4-~~36.4~~ 34.4')			
33	Black and white mottled schist, medium hard to hard, porous			
34	to pitted, laminated to parting bedding @ 20-45° angles,			
35	(actual recovery line) close to moderately close fracturing, slightly to high			
36	weathering			
37	CORE RUN 6: (~~36~~.4-39.4') Black and white mottled schist,			
38	medium hard to hard, porous to pitted, laminated to parting			
39	bedding @ varying angles, close to mod. close fracturing, slightly weathered			
40	CORE RUN 7: (39.4-41.4') same as run 6			
41				
42	CORE RUN 8: (41.4'-46.4') Black & white mottled schist,			
43	hard, porous to pitted, laminated to parting bedding,			
44	close to moderately close fracturing slightly to			
45	moderate weathering			

Depth(feet)	Sample Number	Blows on Sampler	Soil Components CL SL S GR	Rock Profile	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
46					1615						
47					1634	9	100%	100%		0.5	1.9 ppb O top of rod
48											0 ppb = breathing zone
49											
50											20 Min/10 gal = water 1655
51					1644						
52											
53											
54											
55											
56											
57											
58											
59											
60											
61											
62											
63											
64											
65											
66											
67											
68											
69											
70											
71											
72											
73											
74											
75											

Depth(feet)	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content: Dry	Moist	Wet
46		○	○	○
	CORE RUN 9 (46.4' — 51.4')	○	○	○
47				
48	Black and white mottled schist, hard, porous to pitted, laminated to banding bedding at varying	○	○	○
49		○	○	○
50	angles, close to wide fracturing, slightly to	○	○	○
51	moderate weathering.	○	○	○
52		○	○	○
53		○	○	○
54		○	○	○
55		○	○	○
56		○	○	○
57		○	○	○
58		○	○	○
59		○	○	○
60		○	○	○
61		○	○	○
62		○	○	○
63		○	○	○
64		○	○	○
65		○	○	○
66		○	○	○
67		○	○	○
68		○	○	○
69		○	○	○
70		○	○	○
71		○	○	○
72		○	○	○
73		○	○	○
74		○	○	○
75		○	○	○

APPENDIX F – WELL PURGE AND SAMPLE RECORD

FORMER HEXAGON LABORATORY WELL PURGE & SAMPLE RECORD

Site Name: Former Hexagon Laboratory Site Well ID: _____

Location: Bronx, NY Date: _____

Initial Depth to Water: _____ ft TOIC Start Time: _____

Total Well Depth: _____ ft TOIC End Time: _____

Depth to Pump: _____ ft TOIC ☐ Bailer ☐ Pump

Initial Pump Rate: _____ L/min Pump Type: _____

adjusted to: _____ L/min at _____ minutes Well Diameter: _____ inches

adjusted to: _____ L/min at _____ minutes Well Volume: _____ gallons

Time	Purge Volume (gallons)	pH (s.u.)	Temp. (ºC)	ORP (mV)	Conductivity (mS/cm)	DO (mg/L)	Turbidity (NTU)	Water Level (ft)
Final Sample Data:								

Sample ID: _____ Duplicate? ☐ Duplicate Sample ID: _____

Sample Time: _____ MS/MSD? ☐

Analyses:	Methods:
☑ VOCs	☐ 8260
☑ SVOCs	☑ 8270
☑ Metals	☐ 6010/7074
☐ _____	☐ _____
☐ _____	☐ _____

Sampler(s): _____

Comments: _____

APPENDIX G – FIELD SAMPLING PLAN

DRAFT
Field Sampling Plan
Former Hexagon Laboratories Site
Site No. 203003
Bronx County, New York

May 2012

Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 Broadway
Albany, New York 12233

Prepared by:

ECOLOGY AND ENVIRONMENT ENGINEERING, P.C.
368 Pleasant View Drive
Lancaster, New York 14086

Table of Contents

List of Tables

Table **Page**

1 Introduction

Ecology and Environment Engineering, P.C. (EEEPC) has prepared this Field Sampling Plan (FSP) under contract to the New York State Department of Environmental Conservation (NYSDEC) (Work Assignment Number D004442-15) as part of the Site Management Plan (SMP) for the Former Hexagon Laboratories (Hexagon) Site Bronx County, New York (see the site map in Appendix C of the SMP).

Hexagon Laboratories manufactured pharmaceuticals, pharmaceutical intermediates, and a large array of other organic chemicals from the mid-1940s through 1988. The facility has a history of chemical spillage as far back at the 1980s when there were complaints to local elected officials about dumping by Hexagon Laboratories. In 1986, NYSDEC directed Hexagon to install monitoring wells and conduct groundwater sampling in response to past releases from their site. The plant was closed before a plan could be implemented.

In December 1993, the site was reclassified as a Class 2 site because of contaminated groundwater. After completion of the remedial work described in the Record of Decision (ROD) for the Operable Unit (OU) 1, Soils, and the ROD for OU-2, Groundwater, some contamination was left in the subsurface soils and in the groundwater at this site, which is hereafter referred to as "remaining contamination."

This FSP describes field investigation procedures to be conducted at the site as part of the SMP.

2 Field Activities

This section provides a summary of the activities and methodologies that will be performed as part of the Hexagon SMP. The work will include soil cover system monitoring, groundwater elevation measurements, sub-surface soil and groundwater sampling, and ancillary tasks.

Prior to fieldwork, a site-specific health and safety plan (HASP), based on the generic HASP provided in Appendix D of the SMP, pertaining to the fieldwork for this investigation needs to be developed. All field activities are expected to be conducted by personnel wearing Level D personal protective equipment (PPE). However, field team members will maintain Level C respiratory protection equipment on site for use should the need arise.

2.1 Soil Cover System Monitoring

The soil cover system will be inspected at four locations scattered throughout the site (approximately 1 location per 100-foot by 100-foot area) annually and anytime an activity at the site may disturb/alter the soil cover system. The thickness of blue stone cover will be checked for relative consistency of 6 inches thickness throughout the site and verified that the geotextile barrier is in place below the blue stone. Photographs will be taken of the soil cover location relative to structures or features around the site.

At two of the four locations, the fill soil beneath the geotextile barrier will be profiled and sampled via direct-push technology (DPT) methods. A total of three soil samples from each boring will be submitted for laboratory analysis: the fill material from within 1 foot below the geotextile barrier; the fill material from within 1 foot of bedrock or native soil; and the fill material from the approximate middle of the column. Upon completion, boreholes will be backfilled with sand to within 0.3 feet of the geotextile barrier, then 0.5 feet of bentonite chips across the barrier interface (approximately 0.25 feet above and 0.25 feet below), followed by blue stone cover to ground surface.

Prior to initiating intrusive subsurface activities, the subcontractor will coordinate with the Underground Facilities Protection Organization to identify and locate underground utilities.

Direct-Push Sampling Methods Equipment and Supplies

- DPT rig;
- Photo ionization detector (PID) or flame ionization detector (FID);
- Dedicated stainless-steel spoons or macro core samplers;
- Decontaminated split-spoon samplers;
- Measuring tape;
- Dedicated stainless-steel bowls or pans;
- Geotechnical logbook or form;
- Camera;
- Appropriate sample containers (see Table 2-1); and
- A cooler with ice.

Procedures

- Set up DPT rig on soil cover location and begin drilling stainless-steel spoons or macro core samplers through the geotextile barrier.
- Once extracted from the hole, place the split-spoon sampler or macro core sleeve on a sheet of plastic and open to expose the soil core. Scan the core with a PID or FID to evaluate the presence and concentration of organic vapors. Record a description of the soil core in the logbook or form;
- Place the appropriate soil sample portion in a stainless-steel pan using a dedicated stainless-steel spoon or trowel and mix the sample thoroughly and fill the appropriate sample container;
- Place samples in a cooler maintained with ice at 4°C upon collection;
- Backfill the borehole with sand to within 0.3 feet of the geotextile barrier, then 0.5 feet of bentonite chips across the barrier interface (approximately 0.25 feet above and 0.25 feet below) and hydrate with water. Place blue stone cover to match ground surface;

- Package and ship the samples to the laboratory via overnight delivery with chain of custody (COC) documents prepared in accordance with the procedures specified below; and

- Decontaminate downhole equipment according to procedures described in Section 2.8 prior to next use.

2.2 Water Level Survey

Static groundwater level measurements will be collected from the four monitoring wells in a single day prior to well purging and sampling activities.

Equipment and Supplies

- Electronic water-level indicator graduated to 0.01 foot;

- Field logbook or sample forms;

- Laboratory-grade detergent solution in a spray bottle;

- Distilled water in a spray bottle; and

- Paper towels.

Procedures

- Slowly lower the electronic water-level probe of the instrument until the indicator light illuminates and/or the alarm sounds indicating water. Read the depth to water from a marked reference point on the well casing and record in logbook or form.

- Decontaminate any part of the water level indicator that was submerged according to procedures described in Section 2.8 prior to next use.

2.3 Monitoring Well Redevelopment

If issues are identified during previous sampling events, site monitoring wells may need to be redeveloped. Well development will be performed using the equipment and procedures described below, with a surge block necessary for 4-inch diameter wells. Development water from the wells will be contained and handled according to methodology described in Section 2.8.

Equipment and Supplies

- PID or FID;

- Electronic oil/water-level indicator graduated to 0.01 foot;

- Submersible pump with new discharge tubing;
- Surge block (for wells 4-inch and larger);
- Power source to operate pump;
- Well development forms;
- pH/temperature/conductivity meter;
- Turbidity meter;
- Laboratory-grade detergent solution in a spray bottle;
- Distilled water in a spray bottle; and
- Paper towels.

Groundwater Monitoring Well Redevelopment Procedures

- Slowly lower the electronic oil/water-level probe of the instrument until the indicator light illuminates and/or the alarm sounds; read the depth to water from a marked reference point on the well casing and record on the well development form.
- Lower the probe to the bottom of the well casing and read the total depth of the well from the marked reference point on the well casing. Record this depth on the well development form.
- Calculate the volume of water in the well.
- Decontaminate the water-level indicator.
- Connect discharge tubing and insert the pump to the midpoint of the well screen and begin to pump water from the well into either a 55-gallon drum or into a holding tank. Pumping will occur at the maximum flow rate that will not draw the water down to the pump. Use a surging method throughout the well screen/open borehole in order to draw fine sediments out of the sand pack/formation and into the well for removal. Connect a surge block above the pump for 4-inch diameter wells. Containerize the development water into a tank or 55-gallon steel drums.
- Record the temperature, pH, conductivity, and turbidity on the well development form at least every 10 minutes or at the removal of each well volume.

- Continue well development until pH, specific conductance, and temperature have stabilized over three consecutive readings and turbidity of the discharge is not greater than 50 nephelometric turbidity units (NTUs).

- If pH, specific conductance, and temperature have stabilized but the turbidity goal of 50 NTUs has not been met, well development will be considered complete after two hours of purging.

- Decontaminate the pump and the meters according to procedures described in Section 2.8 prior to next use.

2.4 Monitoring Well Sampling

One round of groundwater samples will be collected annually from the four monitoring wells in the area (two 4-inch diameter bedrock wells and two 2-inch diameter overburden wells). Groundwater sampling can be performed by traditional or low-flow methods using the equipment and procedures described below. Purged water will be managed using the equipment and procedures described below. All groundwater and product samples will be submitted for the analyses listed below.

2.4.1 Bailing Sampling Methods

Equipment and Supplies

- Electronic water level indicator graduated to 0.01 foot;

- Disposable polyethylene bailers and new polypropylene line;

- pH/temperature/conductivity meter;

- Turbidity meter;

- Appropriate sample containers (see Table 2-2);

- A cooler with ice.

- Geotechnical logbook or sample forms;

- Laboratory-grade detergent solution in a spray bottle;

- Distilled water in a spray bottle; and

- Paper towels.

Procedures

- Calibrate all field measurement devices daily in accordance with manufacturers' instructions;
- Decontaminate the water level probe;
- Slowly lower the electronic water level probe of the instrument until the indicator light illuminates and/or the alarm sounds and record in the logbook the depth to water from a marked reference point on the top of the well casing;
- Lower the probe to the bottom of the well casing and record the total depth of the well from a marked reference point in the logbook or groundwater sample purge form;
- Calculate the volume of water in the well and record in the logbook or groundwater sample purge form;
- Slowly lower a new disposable polyethylene bailer below the water surface and remove a small volume of water;
- Record the initial temperature, pH, conductivity, and turbidity in the logbook;
- Begin to purge three to five times the volume of water standing in the well casing. Containerize the purged water into a tank or 55-gallon steel drum;
- Record pH, specific conductance, temperature, and turbidity at least every five minutes or at the removal of each well volume until stabilization of all parameters is achieved. The purging will be considered complete after the field parameters have stabilized for three successive readings. The readings are considered stable when they are within the following United States Environmental Protection Agency (EPA) guidelines:
  - 0.1 for pH;
  - 3% for specific conductance;
  - 10% for temperature; and
  - 10% for turbidity.
- Purge until pH, specific conductance, and temperature have stabilized over three consecutive readings, turbidity of the discharge is 50 NTUs or less, and at least three well volumes have been removed;
- If 50 NTUs cannot be obtained after five well volumes, collect the sample volumes for all analytical parameters;
- Place samples in a cooler maintained with ice at 4°C upon collection; and

- Package and ship the samples to the laboratory via overnight delivery with COC documents prepared in accordance with the procedures specified below.

- Decontaminate groundwater sampling equipment according to procedures described in Section 2.8 prior to next use.

2.4.2 Low-Flow Sampling Methods

The objectives and methods for the low-flow procedure are included in the EPA Region II Guidance document titled *Groundwater Sampling Procedure, Low Stress (Low Flow) Purging and Sampling* (EPA 1998). The primary goal of low-flow purging/sampling is to provide groundwater quality data that are representative of actual aquifer conditions with minimal alteration caused by inappropriate or variable sampling techniques.

Equipment and Supplies

- PID or FID;

- Electronic oil/water-level indicator graduated to 0.01 foot;

- Decontaminated submersible pump and dedicated polyethylene tubing;

- Power source to run submersible pump;

- Flow-through cell that can measure pH, temperature, conductivity, turbidity, dissolved oxygen, and oxidation-reduction potential (ORP) parameters;

- Appropriate sample containers (see Table 2-2);

- A cooler with ice;

- Geotechnical logbook or sample forms;

- Laboratory-grade detergent solution in a spray bottle;

- Distilled water in a spray bottle; and

- Paper towels.

Procedures

- Calibrate all field measurement devices daily in accordance with manufacturers' instructions;

- Decontaminate the water-level probe.

- Slowly lower the electronic water level probe of the instrument until the indicator light illuminates and/or the alarm sounds and record in the logbook the depth to water from a marked reference point on the top of the well casing.

- Lower the probe to the bottom of the well casing and record the total depth of the well from the marked reference point in the logbook or groundwater sample purge form.

- Calculate the volume of water in the well and record in the logbook or groundwater sample purge form.

- Lower the submersible pump to the midpoint of the screen, hook up the flow-through cell, and begin to purge the well using an initial flow rate of approximately one liter per minute (L/min). However, adjust the flow rate to minimize drawdown to no more than 0.3 foot during purging and sampling. If 0.3-foot drawdown is exceeded and cannot be re-established, attempt to establish zero drawdown (i.e., water elevation stabilization at a constant or increasing level during purging). An initial decrease in water level greater than 0.3 foot is allowable as long as the water elevation stabilizes and remains stable or increases during the remainder of purging and sampling. If zero drawdown is not possible, then attempt stabilization of water quality parameters with drawdown. If stabilization of parameters cannot be achieved with drawdown, purge the well dry (if possible), then sample following sufficient recharge. Containerize the purged water into either a 55-gallon steel drum or holding tank.

- Record the initial temperature, pH, conductivity, turbidity, dissolved oxygen (DO), and ORP parameters in the logbook or groundwater sample purge form.

- Record ORP, pH, specific conductance, temperature, turbidity, and DO at least every five minutes until stabilization of all parameters is achieved. The purging will be considered complete after the field parameters have stabilized for three successive readings. The readings are considered stable when they are within the following EPA guidelines:
  - 10 millivolts for ORP;
  - 0.1 for pH;
  - 3% for specific conductance;
  - 10% for DO; and
  - 10% for turbidity.

- Purge until pH, specific conductance, temperature, DO, and ORP have stabilized over two consecutive readings and turbidity of the discharge is 50 NTUs

or less. If turbidity is unstable (i.e., varies by >10% or more), but below 50 NTUs, the sample will be collected.

- Disconnect the flow-though cell and collect the sample volumes for all analytical parameters using the pump's outflow tubing. Minimize flow to less than 100 mL/min for volatile organic compound (VOC) collection.

- Place samples in a cooler maintained with ice at 4°C upon collection.

- Package and ship the samples to the laboratory in accordance with the procedures specified in Section 2.5.

- Decontaminate groundwater sampling equipment according to procedures described in Section 2.8 prior to next use.

2.5 Sample Containers, Labeling, Packaging and Shipping, and Custody

The volumes and containers for the soil samples and water samples are presented in Tables 2-1 and 2-2, respectively. Sample preservation and holding time requirements also are presented in these tables.

Sample Packaging and Shipping

Water sample containers will be placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. They will be placed in coolers in such a manner as to eliminate the chance of breakage during shipment and ice in plastic bags will be placed in the coolers to keep the samples at 4°C throughout shipment.

Sample shipment will be performed in strict accordance with all applicable United States Department of Transportation (DOT) regulations. The samples will be shipped to the subcontracted laboratory by an overnight courier service. Arrangements will be made with the subcontracted laboratory's project manager for samples that are to be delivered to a laboratory on a weekend so that holding times are not compromised

Each sample cooler will be accompanied by a COC record to document the transfer of custody from the field to the laboratory. All information requested in the COC record will be completed. In addition, any tracking number assigned by the courier will be listed on the COC record. A copy of the COC form will be retained by the samplers and placed in the project records file. The original will be sealed in a plastic bag and placed inside the cooler.

Sample Custody

A sample is considered to be in custody under the following conditions:

- The sample is directly in one's possession;
- The sample is clearly in one's view;
- The sample is placed in a locked location; or
- The sample is in a designated secure area.

In order to demonstrate that the samples and coolers have not been tampered with during shipment, adhesive custody seals will be used. The custody seals will be placed across the cooler lids in such a manner that they will be visibly disturbed upon opening the cooler. The seals will be signed or initialed and dated by field personnel at the time they are affixed to the cooler.

Documentation of sample COC is necessary to demonstrate that the integrity of the samples has not been compromised between collection and delivery to the laboratory. A COC record will accompany each sample cooler to document the transfer of custody from the field to the laboratory. All information requested in the COC record will be completed. One copy of the COC form will be retained by the sampler and placed in the project records file. The remaining pages will be sealed in a plastic bag and placed inside the cooler. Upon receipt at the laboratory, the COC forms will be completed. It is the responsibility of the laboratory to document the condition of custody seals and sample integrity upon receipt.

2.6 Field Quality Control (QC) Samples

Field QC samples include field duplicates, trip blanks, and additional volume for laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses.

- Field duplicates will be collected from at a frequency of one per sample round.
- Trip blanks for water samples will be prepared by the laboratory, transported to the site with the laboratory bottles, and returned to the lab for analysis at the rate of one per shipping cooler containing water samples collected for VOC analysis.
- Extra volume will be collected for laboratory MS/MSD analysis will be collected at a frequency of one set per 20 samples per sample round.

2.7 Analytical Program

The laboratory should follow the NYSDEC Analytical Services Protocol (ASP) for analytical methods, quality assurance (QA)/QC, holding times, and reporting requirements, except as noted below (NYSDEC 2005). Laboratory data will be reported with full data package (Category B) and standard laboratory electronic data deliverables (EDD) consistent with the EPA Region 2 multimedia electronic data deliverable (MEDD) program. Sample analysis results will undergo electron-

ic data processing and review for usability following the NYSDEC Guidance for the Development of Data Usability Summary Reports (DUSRs) (NYSDEC 2010). The preparation and submittal of DUSRs is mandatory by NYSDEC for the first round of analytical results.

2.8 Decontamination Procedures

All decontamination will be performed in accordance with NYSDEC-approved procedures. Sampling methods and equipment will be chosen to minimize decontamination requirements and prevent the possibility of cross-contamination. All intrusive and groundwater sampling equipment will be decontaminated before and after each location is drilled and sampled. Decontamination of large downhole equipment will consist of the following:

- Removal of foreign matter; and
- High-pressure steam cleaning.

The following alternative procedure will be used for smaller equipment and may also be employed for downhole tooling:

- Initially remove all foreign matter;
- Scrub with brushes in Alconox solution;
- Rinse with deionized water; and
- Allow to air dry.

A temporary decontamination area may need to be established on-site using heavy plastic sheeting as a pad to decontaminate down-hole tooling. Fluids generated during decontamination will be handled according to procedures described in Section 2.9.

2.9 Investigation-derived Waste Management

The following types of IDW are expected to be generated: groundwater from well redevelopment or purging, equipment decontamination water, spent personal protective equipment (PPE), and disposable bailers. The development, purge and decontamination waters will be placed in a DOT-approved tank or 55-gallon drums stored at the site on wooden pallets pending analysis and disposal. All drums containing IDW will be labeled as to their contents, the site name, location where the material was generated, and date the waste was generated. A composite water sample should be collected for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, semivolatile organic compounds (SVOCs), and metals. Pending the results of the analysis, the IDW will be hauled off-site for proper disposal at an appropriate facility.

If field screening indicates that spent PPE and the disposable bailers are contaminated, this waste will be shipped off-site for appropriate disposal with the soil and water waste. Otherwise, this material will be double-bagged and disposed of off-site as non-regulated solid waste.

2.10 Field Records

All field logs will be kept in a bound notebook containing numbered pages unless a specific field form is completed. All entries will be made in waterproof ink and the time of the entry will be recorded. The top of each page of the logbook or field form will contain the project name, and date that the entries on that page were recorded. No pages will be removed for any reason. Corrections will be made by single-line cross out and insertion of new text. Corrections will be initialed by the maker. The field logs will include both site- and task-specific information.

3 References

New York State Department of Environmental Conservation (NYSDEC). 2010. Appendix 2B of DER-10 Technical Guidance for Site Investigation and Remediation, May, 2010.

_____. 2005. *NYSDEC Modifications to EPA Region 9 TO-15 QA/QC Criteria.*

United States Environmental Protection Agency (EPA). 1998. *Groundwater Sampling Procedure, Low Stress (Low Flow) Purging and Sampling,* Region II Guidance document.

Tables

Table 2-1 Summary of Sample Containers, Amounts, Preservation, and Holding Times for Soil Samples

Analytical Test	Analytical Method	Sample Size	Containers	Preservation Requirements	Maximum Holding Time [a]
VOCs	8260B	(1) 40 mL VOA Vial with MeOH and (2) 40 mL VOA vials with DI water.	Full	Cool 4°C	14 days
TCLP VOC	1311/8260B	(2) 8 oz. Glass jar with Teflon-lined cap	Full	Cool 4°C	14 days
TCLP Metals	1311/6010C/7471B				180 days except mercury 28 days
pH	9045D				ASAP
Ignitability	1030				28 days

Note:
[a] All number of days are from date of collection.

Key:
ASAP = As soon as possible.
ºC = Degrees Celsius.
MeOH = Methanol.
NA = Not applicable.
oz. = Ounce.
TCLP = Toxicity characteristic leaching procedure.
VOA = Volatile organic analysis.
VOC = Volatile organic compound.

Table 2-2 Summary of Sample Containers, Amounts, Preservation, and Holding Times for Aqueous Samples

Analytical Test	Analytical Method	Sample Size [a,b]	Preservation Requirements	Maximum Holding Time [c]
VOCs	8260C	(3) 40 mL VOA Vials	HCl, Cool 4°C	14 days
Nitrate and Nitrite	9056	(2) 40 mL VOA Vials	Cool 4°C	28 days
Sulfate	9056			28 days
Chloride	9056			28 days
Sulfide	SM4500-S-F	(4) 125ml plastics	Zinc Acetate and Sodium Hydroxide to pH >12;	7 days
Ferrous Iron	Mod 7199	(2) 40 mL VOA Vials	HCl to pH <2	7 days
Total Iron	6010C	(1) 250-ml plastic	HNO_3 to pH <2	180 days
qPCR CENSUS DNA for Dehalococcoides	N/A	(1) Bio-Flo filter in Falcon Tube (see SOP in Appendix E)	Cool 4°C	
Functional Genes TCE, BVC, VC	N/A			
eBAC	N/A			
TCLP VOCs	1311/8260B	(3) 40 mL VOA Vials	Cool 4°C	14 days
TCLP Metals (RCRA-8)	1311/6010C/7470A	(1) Liter plastic		180 days, except Mercury 28 days
Flashpoint	1010A	(1) Flashpoint bottles		28 days
Corrosivity (pH only)	SM 4500 H B	(1) 250-mL plastic		ASAP
Chlorinated VOC Screening	Color-Tec[d]	NA	NA	ASAP

Notes:
[a] All containers have Teflon-lined lids; VOA containers have Teflon-lined septa.
[b] Samples for MS/MSD analysis require triple the number of containers indicated.
[c] All number of days are from date of collection.
[d] Color-Tec screening to be performed in the field with test kit.

Key:
ASAP = As soon as possible.
ºC = Degrees Celsius.
mL = Milliliter.
NA = Not applicable.
SOP = Standard Operating Procedure.
TCL = Target Compound List.
TCLP = Toxicity characteristic leaching procedure.
VOA = Volatile organic analysis.
VOC = Volatile organic compound.

APPENDIX H – GENERIC QUALITY ASSURANCE PROJECT PLAN

Generic Quality Assurance Project Plan (QAPP) for the Former Hexagon Laboratories Site NYSDEC Site No. 2-03-003

May 2012

Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 Broadway
Albany, New York 12233

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List of Abbreviations and Acronyms

AAS	atomic absorption spectroscopy
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CLP	Contract Laboratory Program
CM	construction management
COC	chain-of-custody
CPR	cardiopulmonary resuscitation
DOT	(United States) Department of Transportation
DUSR	Data Usability Summary Report
ECL	Environmental Conservation Law
EDD	electronic data deliverable
EDP	electronic data processor
ELAP	Environmental Laboratory Accreditation Program
EPA	(United States) Environmental Protection Agency
FS	Feasibility Study
FSP	field sampling plan
GC/MS	gas chromatography/mass spectrometry
IATA	International Air Transport Association
ICP	inductively coupled plasma
ICS	interference check sample
IDW	investigation-derived waste
IIWA	immediate investigation work assignment
IRM	interim remedial measure
LCS	laboratory control sample

List of Acronyms (Cont.)

MDL	method detection limit
MEDD	multimedia electronic data deliverable
mL	milliliter
mL/min	milliliters per minute
MS/MSD	matrix spike/matrix spike duplicate
MSB	matrix spike blank
NELAP	National Environmental Laboratory Accreditation Program
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OVA	organic vapor analyzer
PARCC	precision, accuracy, representativeness, completeness, and comparability
PE	performance evaluation
PID	photoionization detector
PPE	personal protection equipment
ppm	parts per million
PSA	preliminary site assessment
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
RA	remedial action
RD	remedial design
RI	Remedial Investigation
RPD	relative percent difference
SARA	Superfund Amendments and Reauthorization Act of 1986
SDG	sample delivery group
SI	site inspection
SOP	Standard Operating Procedure
SOW	scope of work
SVOC	semi-volatile organic compound
TCLP	toxicity characteristic leaching procedure
TRPH	total recoverable petroleum hydrocarbon
VOA	volatile organic analysis
VOC	volatile organic compound

Distribution List

Party	Affiliation and Title	Revision	Date Sent
QAPP Original Distribution			
	QA Director		
	Project Manager(s)		
	NYSDEC Contracts		
	NYSDEC QA Officer		

Revision List

Revision	Modifications	Distributed

Laboratory Distribution and Approval

All subcontract laboratories working on projects must perform analytical services in compliance with this QAPP.

Party	Affiliation and Title	Revision	Date Sent
QAPP Original Distribution			

This page must be completed and returned to NYSDEC with each revision of the QAPP.

Laboratory certifies that it will conduct analytical services in compliance with QAPP unless modified by any project-specific requirements listed in the site-specific QAPP or approved laboratories exceptions or clarifications in the subcontract supplemental agreement.

Executed this day of , 20

_____
Subcontractor Laboratory

_____
Signature

_____
Name

_____
Title

1 Project Management

This generic Quality Assurance Project Plan (QAPP) has been prepared in support of projects performed for the New York State Department of Environmental Conservation (NYSDEC).

The QAPP is applicable to the former Hexagon Laboratories project and is to be implemented by site monitoring personnel and is subject to regulatory oversight by NYSDEC and must be conducted in accordance with NYSDEC regulations.

This QAPP has been prepared in accordance with "United States Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans," final, EPA QA/R-5 (March 2001) and incorporates NYSDEC requirements. This QAPP presents the policies, organization, objectives, functional activities, and specific quality assurance/quality control (QA/QC) procedures that will be employed by personnel of the site monitoring firm to ensure that all technical data generated are accurate, representative, and ultimately capable of withstanding judicial scrutiny. These activities will be implemented under the requirements of the site monitoring firm's comprehensive QA program as documented in the corporate Quality Management Plan (QMP).

The QAPP is formatted to address the four major sections listed in the EPA QAPP guidance document: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability.

1.1 Project Organization

The organizational chart for the environmental investigation, design, or construction project work in New York is presented as Figure 1-1. The property owner and project team members are primarily responsible for implementation of the QA program on NYSDEC related projects. All project communications are directed through the site-specific project manager. The site-specific project manager is the primary point of contact for the NYSDEC Project Manager and technical staff. The QA Officer for the site-specific work provides independent review functions to verify that the projects are implemented in accordance with applicable QA documents. The site-specific project manager is responsible for independent oversight of projects involving engineering services for design and construction. The

roles and specific QA responsibilities of key project personnel are described below.

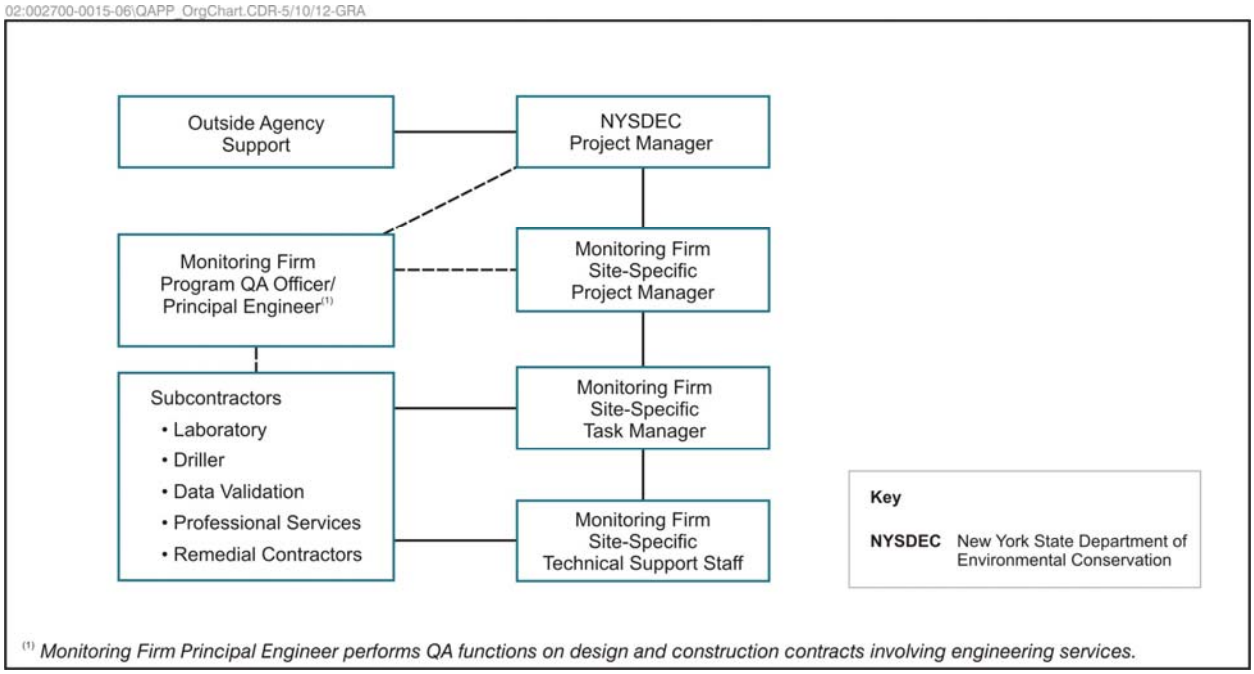

Figure 1-1 Organization Chart

Project Manager

The site-specific project manager is responsible for QA/QC functions for all task-specific operations on NYSDEC projects, and will coordinate with the property owner on issues that impact the overall quality of the monitoring firm's performance on the NYSDEC contract.

The site-specific project manager will also be responsible for the overall quality of work performed under project activities as it relates to the following specific roles:

- Overseeing day-to-day performance including all technical and administrative operations;
- Interfacing frequently with the NYSDEC Project Manager and technical staff;
- Tracking schedules and budgets and managing of mobilization and contract closeout activities;
- Selecting and monitoring field staff;
- Managing the development of detailed work plans; and

- Reviewing and approving all final reports and other work products.

Task Managers

Task Managers will be assigned to direct specific work activities. Task Managers are responsible for leading and coordinating the day-to-day activities of the field effort or other assigned task. The Task Manager carries out the specific QA/QC responsibilities of the Project Manager for work performed under their task.

Corporate or Program QA Officer

The monitoring firm's Corporate QA Director is responsible for ensuring compliance with the site-specific QA program.

The Program QA Officer is responsible for oversight of all QA/QC activities for NYSDEC projects. The QA Officer will remain independent of day-to-day, direct project involvement but will have the responsibility for ensuring that all project and task-specific QA/QC requirements are met. The QA Officer will have direct access to corporate executive staff, as necessary, to resolve any QA/QC problems, disputes, or deficiencies. The QA Officer's specific duties include:

- Reviewing and approving the QAPP;
- Conducting field and laboratory audits in conjunction and keeping written records of the audits;
- Coordinating with the NYSDEC technical staff, Project Manager, Task Managers, and laboratory management to ensure that QA objectives appropriate to the project are set and that laboratory and field personnel are aware of these objectives; and
- Recommending, implementing, and/or reviewing actions taken in the event of QA/QC failures in the laboratory or field.

Project Chemist

The Project Chemist is responsible for data validation and verification, generation of Data Usability Summary Reports (DUSRs), and independent assessment of the hard copy and electronic analytical data. The Project Chemist will report nonconformance with QC criteria (including an assessment of the impact on data quality objectives) to the appropriate managers.

Technical Support Staff

The technical support staff for this program will be drawn from the monitoring firm's pool of corporate resources. The technical support staff will implement project and site tasks, analyze data, and prepare reports/support materials. All support personnel assigned will be experienced professionals who possess the de-

gree of specialization and technical competence necessary to perform the required work effectively and efficiently.

Laboratories

Laboratories providing analytical services will be chosen as appropriate for the project requirements. All laboratories will be certified by the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) for the methods that they are contracted to perform. Laboratories performing for Superfund sites with full data packages must be certified by NYSDOH for Contract Laboratory Program (CLP) analysis.

The laboratory QA programs are reviewed and approved by the QA Officer or the Project Chemist, and will be submitted to NYSDEC for approval. Copies of the laboratory QA manuals are available on request. The laboratory must provide an experienced Project Manager and a QA Officer that is independent of the day-to-day operations of the laboratory. The specific duties of the laboratory Project Manager and QA Officer for NYSDEC activities include:

- Reviewing the QAPP to verify that analytical operations will meet project requirements;
- Documenting review and approval of QAPP on distribution page;
- Reviewing receipt of all sample shipments and notifying the Project Manager and Project Chemist of any discrepancies within one day of receipt;
- Rapidly notifying the site-specific project manager and Project Chemist regarding laboratory nonconformance with the QAPP or analytical QA/QC problems affecting project samples; and
- Coordinating with the site-specific project manager and Project Chemist, and laboratory management to implement corrective actions approved by NYSDEC or others as applicable.

1.2 Problem Definition/Background

NYSDEC has performed a remedial action on both the site soils (OU1) and on the groundwater of the site (OU2). Contamination is still present within the groundwater and bedrock beneath the site and as such has the potential to contaminate the soils of the soil cover system. Therefore, any and all work that has the potential to disturb the soil cover system or impact the monitoring wells or the groundwater is to be carried out consistent with NYSDEC and EPA requirements, protocols, and guidance.

1.3 Project Description

The work covered by this QAPP is defined under the Site Management Plan for the Former Hexagon Laboratories site. If necessary, site-specific QAPP information will be provided as an appendix to the field sampling plan (FSP).

1.4 Quality Objectives and Criteria

Quality objectives are qualitative or quantitative statements derived from the systematic planning process. Quality objectives are used to clarify the goals of the project and define the appropriate type of data to collect to support project decisions. General quality objectives for NYSDEC projects are summarized in Table 1-1.

Acceptance and performance criteria establish the quality and quantity of data needed to meet the project quality objectives. General acceptance or performance criteria for the collection, evaluation, or use of environmental data for NYSDEC projects are outlined in Section 2.5, Analytical Methods. Quality objectives or acceptance and performance criteria applicable to a project are specified in the site-specific QAPP or work plan.

1.4.1 Data Assessment Definitions

Acceptance and performance criteria are often specified in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Numerical acceptance criteria cannot be assigned to all PARCC parameters, but general performance goals are established for most data collection activities. Numerical goals for analytical methods are presented in Section 2.4. Data assessment procedures throughout the QAPP clearly outline the steps to be taken, responsible individuals, and implications if QA objectives are not met. PARCC parameters are briefly defined below.

Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value, usually stated in terms of standard deviation or coefficient of variation. It also may be measured as the relative percent difference (RPD) between two values. Precision includes the interrelated concepts of instrument or method detection limits and multiple field sample variance. Sources of this variance are sample heterogeneity, sampling error, and analytical error.

Table 1-1 General Data Quality Objectives, NYSDEC Projects

Data Collection Activity	Quality Objectives	Standards[a]	Acceptability/ Performance Criteria[b]
Sampling and Analysis	To have samples and analytical results that accurately represents the nature and extent of contamination at the site. Data must be of sufficient quality to meet all regulatory requirements and allow assessment of impacts on human health by comparison to New York State criteria or background values. Data also may be used for long-term monitoring or to meet regulatory permit requirements. In these cases, data must meet the requirements of the permit.	■ NYSDEC Ambient Water Quality Standards ■ NYSDOH Soil Vapor Intrusion Guidance Values ■ NYSDEC Remedial Program Soil Cleanup Objectives	■ Data must be collected under an approved FSP using approved SOPs. Data must meet the acceptance and performance criteria documented in Section 2 of this QAPP. ■ Reporting limits should be below risk-based screening values for 90% of target analytes and 100% of critical analytes of concern. ■ Data must be compared to standards.
Field Screening Analysis	To have samples and analytical results that effectively indicate the nature and extent of contamination at the site. Technical personnel use data to determine the best locations to collect samples for laboratory analysis.	■ None	■ Data must be collected under an approved FSP using approved SOPs. Data must meet the acceptance and performance criteria for the screening method. ■ Reporting limits should be below anticipated concentrations of critical analytes of concern.
Subsurface Logging	To provide a description of the subsurface soils that is consistent and accurate, and to record drilling and sampling procedures and well construction details.	■ Sit-specific SOPs (including Geologic Logging and Monitoring Well Installation)	■ Accurate, consistent, signed, and legible documentation as described in SOPs. ■ Unconsolidated materials described according to the Unified Soil Classification System. ■ Rock/soil material described using standard geologic nomenclature.
Surveying	To relate project work locations (including sample, monitoring well, and test pit locations) to existing local benchmarks.	■ Surveying subcontract ■ Differential correction for GPS data	■ Relation of all survey points to existing/known benchmarks. ■ Accurate horizontal coordinates (±0.5 foot for wells; ±3 feet for GPS locations). ■ Accurate vertical elevations (±0.01 foot) for permanent monitoring well locations.
Field Records	To document all field activities and to allow accurate representation field events in the final report. Records must be capable of withstanding legal scrutiny.	■ Section 2 of the QAPP ■ Site-specific SOPs (Field Activities Logbooks)	■ Consistency between field and laboratory data. ■ Clear and legible documentation for sample collection and equipment decontamination for final report.

Table 1-1 General Data Quality Objectives, NYSDEC Projects

Data Collection Activity	Quality Objectives	Standards[a]	Acceptability/ Performance Criteria[b]
Outside Records	To use the most current reference values, reports, or data from outside sources in data assessments and recommendations for the site.	None	■ All versions of data or standards must be the most current values available. ■ Data or standards must be accurately incorporated into the final report.
Data Review and Assessment	To review and verify data are generated according to the QAPP, and assign data qualifiers as necessary to indicate limitations on data usability.	■ NYSDEC DUSR Guidance ■ EPA Region 2 Data Validation SOPs ■ EPA National Functional Guidelines	■ Data must be reviewed by Project Chemist meeting minimum NYSDEC qualifications. ■ Data qualifiers or changes to data must be documented in a DUSR.

Notes:

[a] Major standards.
[b] Major or noteworthy acceptability criteria. All performance criteria must be verified using procedures listed in the QAPP.

Key:

GPS = Global Positioning System.
NYSDEC = New York State Department of Environmental Conservation.
NYSDOH = New York State Department of Health.
SOP = Standard Operating Procedure.
QAPP = Quality Assurance Project Plan.

Accuracy

Accuracy measures the bias of the measurement system. Sources of this error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis. Data interpretation and reporting may also be significant sources of error. Typically, analytical accuracy is assessed through the analysis of spiked samples and may be stated in terms of percent recovery or the average (arithmetic mean) of the percent recovery. Blank samples are also analyzed to assess sampling and analytical bias (i.e., sample contamination). Background measurements similarly assess measurement bias.

Representativeness

Representativeness expresses the degree to which data represent a characteristic of a population, a parameter variation at a sampling point, or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with proper design of the measurement program. Sample/measurement locations may be biased (judgmental) or unbiased (random or systematic). For unbiased schemes, sampling must be designed not only to collect samples that represent conditions at a sample location, but also to select sample locations, which represent the total area to be sampled.

Completeness

Completeness is defined as the percentage of measurements performed that are judged to be valid. Although a quantitative goal must be specified, the completeness goal is the same for all data uses—that a sufficient amount of *valid* data be generated. It is important that critical samples are identified and plans are made to ensure that valid data are collected for them.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset may be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through the use of standard techniques to collect and analyze samples.

1.5 Special Training/Certification

The monitoring firm for the site is committed to providing vigorous training in health and safety procedures, the proper use of protective equipment, and overall policy objectives. General training requirements for NYSDEC activities are as follows:

- Monitoring firm employees that participate in on-site activities must have completed the 40-hour health and safety training program and the cardiopulmonary resuscitation (CPR)/first aid certification course. To continue such participation, each employee must successfully complete a minimum of eight hours of refresher training, annually; and

- All personnel shipping samples must complete the United States Department of Transportation (DOT) hazardous materials transportation training and certification, including training in specific International Air Transport Association (IATA) regulations if air shipments are going via FedEx.

1.6 Documentation and Records

The monitoring firm's Program QA Officer will approve the site-specific QAPP and maintain the most current approved version of the document. The site-specific Project Manager is responsible for providing the most current copy of the site-specific QAPP and other planning documents to the project team members.

In addition to the site-specific QAPP and other planning documents, the primary documentation for the project is field records and analytical data packages. Requirements for field records are documented in the site monitoring firm's Standard Operating Procedures (SOPs) for Field Activities Logbooks and Geotechnical Logbooks and are described briefly below. Requirements for analytical data packages for NYSDEC activities are also described below. The remainder of the QAPP describes additional project documentation and record requirements for QA/QC assessments, data validation, data management, and other areas.

1.6.1 Field Documentation

Sample Identification

Samples will be identified using the format described below. Each sample will be labeled, chemically preserved (if required), and sealed immediately after collection. To minimize handling of sample containers, labels will be completed prior to sample collection as practicable. The sample label will be completed using waterproof ink and will be firmly affixed to sample containers and protected with clear tape. The sample label will give the following information:

- Date of collection;
- Unique sample number;
- Analyses requested; and
- Preservation.

Each sample will be referenced by sample number in the logbook and on the chain-of-custody (COC) record.

Individual samples will be identified by a unique alphanumeric code. Normal field samples (non-quality-control) will be numbered according to the following convention:

SSS-MC-###-Q

SSS - Three letter code for site name

MC - Matrix code as designated below
- Sequential sample number
Q - Quality control sample code such as D for duplicate, F for filtered, S for split, etc.

The matrix codes are as follows:

AS - Bulk Asbestos
BA - Indoor Air from Basement or Crawlspace
DW - Drinking Water
EB - Equipment Blank
FA - Indoor Air, First Floor (not basement)
GW - Groundwater
OA - Outdoor Air
SD - Sediment
SB - Subsurface Soil
SF - Surface Soil
SS - Sub-slab Vapor
SV - Soil Vapor
SW - Surface Water
TB - Trip Blank
WS - Waste

Samples collected with an additional volume for matrix spike/matrix spike duplicates (MS/MSD) will be designated on the COC.

Field Logs and Data Forms

Field logs and data forms are necessary to provide sufficient data to enable participants to reconstruct events that occurred during the project and to refresh the memory of field personnel should they be called upon to give testimony during legal proceedings. Field logs also should document any deviations from the work plan, QAPP, or other applicable planning document. Procedures for recording information are specified in the Field Sampling Plan. All field logs will be kept in a bound notebook containing numbered pages unless a specific field form is completed. All entries will be made in waterproof ink and the time of the entry will be recorded. The top of each page of the logbook or field form will contain the pro-

ject number, project name, and date that the entries on that page were recorded. No pages will be removed for any reason. Corrections will be made according to the procedures given later in this section. The field logs will include both site- and task-specific information.

Recording of information related to site activities is the responsibility of the Task Leader and will include a complete summary of the day's activities at the site and any communications outside the project team. Site information includes:

- Name of the person making the entry (signature);
- Names of team members, subcontractors, and visitors on site;
- Levels of personal protection equipment (PPE):
  - Level of protection originally used,
  - Changes in protection, if required, and
  - Reasons for changes; and
- Time spent on site.

Task-specific information may be recorded in multiple field logbooks. The task-specific information will include:

- Drilling information, including:
  - Method employed,
  - Diameter of borehole and well casing,
  - Materials used,
  - Depth of borehole, and
  - Well construction (if appropriate);
- Documentation on samples collected, including:
  - Construction of existing wells (if appropriate),
  - Sampling location and sample identification number,
  - Sampling depth for subsurface soil and surface water (if depth-specific surface water samples are collected) samples,
  - Flow rate of water from in-place plumbing (500 milliliters per minute [mL/min]) for samples of existing water supplies,
  - Sampling date, time, and personnel,
  - Sample sequence (order in which samples were collected),
  - Equipment used (including the use of fuel-powered units/motors during surface water sampling),
  - Type of sample (e.g., grab, composite, QC) and matrix,
  - Amount of each subsample or aliquot (if sample is a composite), and
  - Sample preservation and verification of preservation;

- Types of field QC samples, including when and where they were collected. The description of rinsate sample collection should include the equipment rinsed and the actual field samples collected with that equipment prior to collection of the rinsate;

- Information regarding well purging including:
  - Depth to water and total well depth,
  - Calculations used for volume purged,
  - Volume purged,
  - Equipment used,
  - Field measurements,
  - Length of purge time, and
  - Date and time well was purged;

- Drum inventory:
  - Type of drum and description of contents, and
  - Description of material in the drum and which ayers were sampled (if performed);

- Field equipment used, equipment identification numbers, and calibration information;

- On-site measurement data;

- Field observations and remarks;

- Weather conditions;

- Decontamination procedures;

- Unusual circumstances or difficulties; and

- Initials of person recording information.

Corrections to Documentation Notebook

As with any data logbooks, no pages will be removed for any reason. If corrections are necessary, they must be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

Photographs

Photographs will be taken as directed by the site-specific Task Leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the task log concerning photographs:

- Date, time, location, and direction photograph was taken;
- Description of the photograph taken;
- Reasons why the photograph was taken;
- Sequential number of the digital photo; and
- Camera system used.

1.6.2 Laboratory Data Reporting

The data packages for all CLP and similar Superfund analytical services are consistent with NYSDEC Analytical Services Protocol (ASP) Category B (July 2005) and, therefore, must include a full data package with all associated sample and QC results, calibrations, and raw data. The data packages for long-term monitoring events are consistent with NYSDEC ASP Category A, and therefore must consist of a case narrative, COC, summary table of sample identifications and sample tracking information, a summary of analytical results, and a summary of QC results. The laboratory will provide a summary package of results for all data packages. The laboratory will provide a summary of the sample analyzed, methods used, and date and time of analysis. The laboratory will provide an electronic data deliverable that matches all data reported on the hard copy analytical report. Electronic data report requirements are described in Section 2.10.

Within 48 hours of sample receipt, the laboratory will provide a sample receipt file and copy of the completed COC.

The analytical summary report will include the sample aliquot analyzed, final extract volume, and dilution factor. The analytical summary data report also will include the laboratory reporting limit and method detection limit (MDL) for all target compounds. These limits will be corrected for percent moisture and all dilution factors. Any compounds found less than the reporting limit, but greater than the MDL will be reported and qualified with a "J" flag as estimated.

QC reports must provide a summary report or batch identifier clearly linking all QC results to actual field sample results. QC summary reports must include the laboratory control limits and flag any result reported outside control limits. The case narrative must include an explanation of all QC results reported outside con-

trol limits. The laboratory must provide copies of any nonconformance or corrective action forms associated with data in the laboratory report.

For Category A, the laboratory should provide copies of chromatograms for any samples for which elevated reporting limits are used because of sample matrix, but no target compounds are found above the reporting limit.

For organic analytes reported in both Category A and Category B deliverables, the laboratory must report results of the most concentrated extract analysis in order to achieve required quantitation limits.

1.6.3 Record Retention

All records related to the project must be stored in secure areas consistent with requirements in the monitoring firm's corporate QMP. All records related to the analytical effort must be maintained at the laboratory or in the office (for field screening data) in lockable filing cabinets for at least one year, except those stored in the computer (i.e., cost information, scheduling, custody transfers, and management records). All records must be maintained in a secure area for a period of six years after the end of the calendar year in which the final report is issued.

Types of records to be maintained in addition to the final technical reports for NYSDEC include the following:

- Field logbooks, sampling documents, photographs, QA/QC records, and any other supporting documentation for collection of field samples;
- Administrative records including time cards, costing, and scheduling information; and
- Client correspondence, subcontractor records, minutes of meetings, and any related project management records.

Types of records to be maintained by the laboratory in addition to the analytical report for the NYSDEC include the following:

- Complete COC records from sample receipt to destruction. Sample destruction records must contain information on the manner of final disposal;
- Supporting documentation for any nonconformance or corrective action forms supplied in the analytical report or related to the analysis of project samples;
- Computer records on disk with magnetic tape backup of cost information, scheduling, laboratory COC transfers, and laboratory management records;

- All laboratory notebooks including raw data such as readings, calibration details, and QC results; and

- Hard copies of data system printouts (i.e., chromatograms, mass spectra, and inductively coupled plasma [ICP] data files).

2 Data Generation and Acquisition

This section of the QAPP contains descriptions of all aspects of the implementation of field, laboratory and data handling procedures to meet the requirements of NYSDEC activities. The QAPP provides the basis for ensuring that appropriate methods are used and thoroughly documented. These procedures will be adapted, as appropriate, to meet the objectives of each NYSDEC project as described in the appropriate work plan.

2.1 Sampling Process Design

The sampling process design is documented in the work plan or in the FSP for each site. The FSP will include a project schedule and a summary table listing the type of samples collected, the sampling location, the rationale for selecting the location, sample handling procedures, analytical methods, and the number and type of QA/QC samples.

2.2 Sampling Methods

The sampling methods are documented in the work plan or in the FSP. The site monitoring firm's sampling SOPs serve as the basis for sampling procedures.

In general, sampling at a site will progress from clean areas to contaminated areas. This minimizes the potential for cross contamination of samples and, subsequently, eliminates data anomalies or misinterpretation of the extent of contamination. The order of sample collection at a specific location normally proceeds as follows:

1. Volatile organic compounds (VOCs) or other volatile parameters;
2. Extractable organics (including total recoverable petroleum hydrocarbons [TRPH]);
3. Oil and grease;
4. Total metals;
5. Dissolved metals;

6. Microbiological samples;

7. Other inorganics; and

8. Physical parameters (including ignitability, corrosivity, and reactivity).

This sequence helps maintain the representativeness of samples and analytical results.

The remainder of this section describes typical procedures for equipment decontamination and the handling of investigation-derived waste (IDW), and sample containers, preservatives, holding times, packing, and shipping. Specific procedures for each site are provided in the work plan or in the FSP.

2.2.1 Equipment Decontamination

Sampling methods and equipment are chosen to minimize decontamination requirements and the possibility of cross-contamination. Equipment or supplies that cannot be effectively decontaminated (e.g., sample tubing or rope) will be disposed of after sampling. Investigation/sampling equipment will be cleaned at the site prior to use, between sampling locations, and prior to transport off-site. Decontamination of field equipment will be noted in the field logbook. If it is necessary to make decontamination procedure changes in the field, the changes will be noted in the logbook. Otherwise, a notation will be made each day that decontamination was conducted as specified in the work plan or in the FSP. Rinsate blanks will be collected to verify the effectiveness of decontamination procedures. If field blanks indicate poor techniques, the QA Officer and Project Manager will ensure techniques are modified and samplers trained appropriately.

All decontamination will be performed in accordance with NYSDEC-approved procedures. Decontamination of large equipment will consist of the following:

- Removal of foreign matter; and

- High-pressure steam cleaning.

Decontamination of heavy equipment will be performed by the subcontractor and will be performed in a decontamination pad approved by NYSDEC.

The following alternative procedures will be used for smaller equipment and may also be employed for downhole tooling such as split spoons and Geoprobe rods or routine sampling equipment:

- Initially remove all foreign matter;

- Scrub with brushes in a laboratory-grade detergent solution (e.g., Alconox);
- Rinse with potable water with a final deionized or distilled water rinse; and
- Allow to air dry.

If sampling for metals is conducted, then an additional rinse with a 10% nitric acid solution will be added between the potable and deionized water rinses.

Sensitive down-hole devices that only contact water (e.g., water level indicator and miniTROLL pressure transducer) may be decontaminated by triple rinsing with deionized or distilled water. A temporary decontamination area will be established in each work area using heavy plastic sheeting as a pad. The decontamination will be performed by the field team.

Fluids generated during decontamination will be handled according to procedures described in Section 2.2.2.

2.2.2 Investigation-Derived Waste (IDW)

Unless otherwise directed by NYSDEC staff, all IDW will be handled in a manner consistent with requirements in the work plan and applicable federal and state regulations. IDW includes disposable equipment and PPE, purge and development waters, drilling fluids, soil cuttings, and decontamination fluids. Waste streams will not be mixed and will be segregated to the maximum extent possible.

Investigation-derived soils and water will be field-screened for organic vapors with an organic vapor analyzer (OVA) or photoionization detector (PID) and visual inspected to initially determine whether these wastes are potentially contaminated. In order to minimize the generation of drummed wastes and the costs associated with storage, testing, transportation, and disposal of drums, IDW will be handled in the following manner:

- **Soil cuttings from boreholes:** as much of the soil cuttings as possible will be used as backfill. Remaining cuttings that are not significantly contaminated (OVA or PID readings of 5 parts per million [ppm] or less and lack of staining, sheen, etc.) will be spread on the ground near the site of generation if the location is in a suitably undeveloped area. If this is not possible or if contamination is suspected, the excess soil cuttings will be drummed;
- **Soil cuttings from monitoring well boreholes:** cuttings that are not significantly contaminated (OVA or PID readings of 5 ppm or less and lack of staining, sheen, etc.) will be spread on the ground near the site of generation if the location is in a suitably undeveloped area. If this is not possible or if contamination is suspected, the excess soil cuttings will be drummed;

- **Development and purge waters from monitoring wells and decontamination water:** water that is not significantly contaminated (OVA or PID readings of 5 ppm or less, lack of sheen, etc.) will be discharged to the surface in the area where it was generated only if the area is suitably undeveloped (e.g., not paved and not on residential property). If the water cannot be discharged to the surface, then it may be discharged to the municipal sanitary sewer system pending receipt of a temporary discharge permit from the local sewer department. Alternatively, significantly contaminated waters or waters that cannot be discharged will be drummed; and

- **Used sampling equipment and PPE:** unless field screening indicates that PPE and other solid wastes are contaminated to the level that they can not be disposed of as non-hazardous waste, this material will be double-bagged and disposed of off-site as non-regulated solid waste.

Wastes that need to be drummed will be placed in DOT approved 55-gallon drums and stored at a central storage location selected by NYSDEC, pending analysis and disposal. Drums will be staged within secondary containment units and covered with a plastic tarp if stored outside. All drums containing IDW will be labeled as to their contents, the site name, location where the material was generated, and date the waste was generated. Composite samples of like wastes will be collected for toxicity characteristic leaching procedure (TCLP) VOCs, TCLP semivolatile organic compounds (SVOCs), TCLP pesticides/herbicides, TCLP metals, PCBs, and pH. A waste disposal firm will then be subcontracted to haul the waste off-site to an appropriate disposal facility as either solid or hazardous waste. The monitoring firm will coordinate drum hauling with the NYSDEC project manager to ensure that NYSDEC, the property Owner, or responsible party is available to sign the waste shipping manifest(s), as legal waste generator.

2.3 Sample Handling and Custody

2.3.1 Sample Containers

The volumes and containers required for sampling activities are indicated in Table 2-1. Prewashed sample containers will be provided by the laboratory and will be wide-mouth jars with Teflon-lined caps unless otherwise indicated. The laboratory must use an approved specialty container supplier, which prepares containers in accordance with EPA bottle-washing procedures. The laboratory must maintain a record of all sample bottle lot numbers shipped in the event of a contamination problem. Trip blanks will be transported to the site inside the same box as volatile organic analysis (VOA) vials or as the air sampling canisters.

Table 2-1 Summary of Analytical Methods, Preservatives, and Holding Times, NYSDEC Projects

Parameter	Method	Containers/Preservative for Solid Samples[a]	Containers/Preservative for Aqueous Samples[a]	Holding Time for Solid Samples[a]	Holding Time for Aqueous or Air Samples[a]
Contract Laboratory Program Analysis					
TCL VOCs	OLM04.2/SOM01.0	Two pre-weighed 40-mL plus one pre-weighed 40-mL vial with stir bar and methanol and one 4-oz. glass vial with septum (if no other containers are shipped)	Three 40-mL glass vials with septa, preserved HCl < pH 2	48 hours for analysis or freezing to <7˚C and 12 days for analysis following freezing	12 days for waters with chemical preservative, and 5 days for unpreserved sample
TCL SVOCs	OLM04.2/SOM01.0	One 8-oz. glass jar	Two 1-L amber glass bottles	12 days/40 days[d]	5 days/40 days[d]
TCL Pest/PCB	OLM04.2/SOM01.0	One 8-oz. glass jar	Two 1-L amber glass bottles	12 days/40 days[d]	5 days/40 days[d]
TAL Metals/ Mercury	ILM05.3	One 8-oz. glass jar	One 1-L HDPE bottle, preserved HNO_3 to pH <2	180 days/26 days for mercury	180 days/26 days for mercury
TAL Cyanide	ILM05.3	One 8-oz. glass jar	One 1-L HDPE bottle, preserved NaOH to pH >12	180 days/12 days for cyanide	180 days/12 days for cyanide
Air/Vapor Samples					
Target VOCs	TO-15[g]	1.0, 1.4, or 6.0 L Minican (depending on lab availability	NA		30 Days
Solid Waste					
Ignitability	SW-846 Chapter 8 (8.1)	One 8-oz. glass jar	One 1-L HDPE bottle for both tests	40 days	40 days
Corrosivity (as pH)	SW-846 Chapter 8 (8.2)	One 8-oz. glass jar		28 days	28 days
Reactivity	SW-846 Chapter 8 (8.3)	One 8-oz. glass jar	Two 1-L HDPE bottles	28 days	28 days

Table 2-1 Summary of Analytical Methods, Preservatives, and Holding Times, NYSDEC Projects

Parameter	Method	Containers/Preservative for Solid Samples[a]	Containers/Preservative for Aqueous Samples[a]	Holding Time for Solid Samples[a]	Holding Time for Aqueous or Air Samples[a]
TCLP Extraction	1311	Two 8-oz. glass jars	Various (see below)	5 days for SVOCs and mercury, 7 days for VOCs, 180 days for metals	5 days for SVOCs and mercury, 7 days for VOCs, 180 days for metals
TCLP Metals/ Mercury	6010B/7471	One 8-oz. glass jar	One 1-L HDPE bottle[c]	26 days[b] for mercury, 180 days for metals	26 days[b] for mercury, 180 days for metals
TCLP Volatile Organics	8260B	One 125-mL VOA jar	Two 40-ml glass vials with septa	7 days	7 days
TCLP Base/ Neutral Acid Extractables	8270C	One 8-oz. glass jar	Two 1-L amber glass bottles	7 days, 40 days for analysis[b]	7 days, 40 days for analysis[b]
TCLP Pesticides	8081A	One 8-oz. glass jar	Two 1-L amber glass bottles	7 days, 40 days for analysis[b]	7 days, 40 days for analysis[b]
TCLP Herbicides	8151A	One 8-oz. glass jar	Two 1-L amber glass bottles	7 days, 40 days for analysis[b]	7 days, 40 days for analysis[b]
TCLP STARS Base/Neutral Extractables	8270C	One 8-oz. glass jar	Two 1-L amber glass bottles	7 days, 40 days for analysis[b]	7 days, 40 days for analysis[b]
TCLP STARS Volatile Organics	8021B or 8260B	One 125 mL VOA jar	Two 40-mL glass vials with septa	7 days[b]	7 days[b]
Additional Methods					
Hardness	130.1	NA	One 1-L HDPE bottle (can combine with metals) preserved HNO_3 to pH <2	NA	180 days
pH	150.2	NA	To be performed in the field	NA	ASAP
TDS	SM 2540C	NA	One 1-L HDPE bottle	NA	24 hours
TSS	SM 2540D	NA	One 1-L HDPE bottle	NA	5 days

Table 2-1 Summary of Analytical Methods, Preservatives, and Holding Times, NYSDEC Projects

Parameter	Method	Containers/Preservative for Solid Samples[a]	Containers/Preservative for Aqueous Samples[a]	Holding Time for Solid Samples[a]	Holding Time for Aqueous or Air Samples[a]
Priority Pollutant Metals	200.7	One 4-oz. glass jar	One 1-L HDPE bottle preserved HNO_3 to pH <2	180 days, 26 days for mercury	180 days, 26 days for mercury
Alkalinity	310.2	NA	One 1-L HDPE bottle	NA	12 days
Nitrate or Nitrite	352.1/353.2/300.0/ 300.1	One 4-oz. glass jar	One 1-L HDPE bottle (can combine with pH and BOD_5)	24 hours	24 hours
Nitrate-Nitrite	353.2/300.0/300.1	One 4-oz. glass jar	One 1-L HDPE bottle preserved H_2SO_4 to pH <2	26 days	26 days
Orthophosphorus	365.1/365.3/300.0/ 300.1	NA	One 1-L HDPE bottle (can combine with pH and BOD_5)	NA	24 hours
Total Phosphorus	365.1/365.3/365.4	One 4-oz. glass jar	One 1-L HDPE bottle preserved H_2SO_4 to pH <2	26 days	26 days
Chloride, Bromide, Sulfate, Fluoride	300.0/300.1 or individual methods	One 4-oz. glass jar	One 1-L HDPE bottle	26 days	26 days
COD	410.3/410.4	NA	One 1-L HDPE bottle (can combine with ammonia and TKN) preserved H_2SO_4 to pH <2	NA	26 days
Oil/Grease	1664A	One 4-oz. glass jar	One 1-L amber glass bottle preserved HNO_3 to pH <2	26 days	26 days
TRPH	1664A (SGT)	One 4-oz. glass jar	One 1-L amber glass bottle preserved H_2SO_4 to pH <2	26 days	26 days
Metals/Mercury	200.7; 245.1/245.2/ 245.7/1631 for mercury	One 4-oz. glass jar	One 125-mL HDPE bottle preserved HNO_3 to pH <2	180 days/26 days for mercury	180 days/26 days for mercury

Table 2-1 Summary of Analytical Methods, Preservatives, and Holding Times, NYSDEC Projects

Parameter	Method	Containers/Preservative for Solid Samples[a]	Containers/Preservative for Aqueous Samples[a]	Holding Time for Solid Samples[a]	Holding Time for Aqueous or Air Samples[a]
Chromium, Hexavalent	218.6/SM 3500-Cr	One 4-oz. glass jar	One 1-L HDPE bottle unpreserved or preserved pH of 9.3 to 9.7 with an ammonia sulfate buffer solution	24 hours from collection for unpreserved soils and 28 days for preserved soils	24 hours from collection for unpreserved water and 28 days for preserved water
PCBs	8082	One 4-oz. glass jar	Two 1-L amber glass bottles	12 days/40 days[d]	5 days/40 days[d]
VOCs and related tests	8260B/8021B/8015B	Two pre-weighed 40-mL with deionized water and one pre-weighed 40-mL vial with stir bar and methanol and one 4-oz. glass vial with septum(if no other containers are shipped)	Three 40-mL glass vials with septa preserved HCl < pH 2	48 hours for analysis or freezing to <7˚C and 12 days for analysis following freezing	12 days for waters with chemical preservative, and 5 days for unpreserved sample
SVOCs and related tests	8270C	One 8-oz. glass jar	Two 1-L amber glass bottles	12 days/40 days[d]	5 days/40 days[d]
Chlorinated Dioxins and Furans	8280A or 8290	One 8-oz. glass jar	Two 1-L amber glass bottles	30 days/45 days[d]	30 days/45 days[d]
Cyanide	9010C/9012B	One 4-oz. glass jar	One 1-L HDPE bottle preserved NaOH to pH >12	12 days	12 days
TOX	9020B	One 4-oz. glass jar	One 1-L amber glass preserved H_2SO_4 to pH <2	7 days	7 days
pH	9045C/9040B	One 4-oz. glass jar	One 125-mL HDPE bottle	ASAP	ASAP
Total Phenols	420.1	One 4-oz. glass jar	One 1-L amber glass preserved H_2SO_4 to pH <2	26 days	26 days

Table 2-1 Summary of Analytical Methods, Preservatives, and Holding Times, NYSDEC Projects

Parameter	Method	Containers/Preservative for Solid Samples[a]	Containers/Preservative for Aqueous Samples[a]	Holding Time for Solid Samples[a]	Holding Time for Aqueous or Air Samples[a]
Total Organic Carbon	Lloyd Kahn; SM 5310B, C, or D; ASTM D2579-93 (A or B)	One 4-oz. glass jar	NA	26 days	26 days
Total Glycol	DEC 89-9	One 4-oz. glass jar	One 1-L glass	26 days	14 days
Specific Gravity	SM 2710F	NA	Can combine with other analyses (requires 500 mL)	NA	40 days
TKN	351.1/351.2	One 4-oz. glass jar	One 1-L HDPE bottle (can combine with COD and ammonia) preserved H_2SO_4 to pH <2	26 days	26 days
Ammonia	350.1	One 4-oz. glass jar	One 1-L HDPE bottle (can combine with COD and TKN) preserved H_2SO_4 to pH <2	26 days	26 days

Table 2-1 Summary of Analytical Methods, Preservatives, and Holding Times, NYSDEC Projects

Parameter	Method	Containers/Preservative for Solid Samples[a]	Containers/Preservative for Aqueous Samples[a]	Holding Time for Solid Samples[a]	Holding Time for Aqueous or Air Samples[a]
BOD_5	SM 5210B	NA	One 1-L HDPE bottle (can combine with pH and nitrates)	NA	24 hours

[a] All samples to be cooled to 4°C except for metals analysis samples shipped alone. Sample containers must have Teflon-lined lids. Holding times are based on verified times of sample receipt and are consistent with NYSDEC requirements. 0.008% Na2S2O3 to be added to water samples in the presence of residual chlorine.
[b] Time listed is from TCLP extraction.
[c] TCLP analysis of water samples assumes less than 0.5% solids.
[d] Holding time is 5 days from collection to extraction and 40 days from extraction to analysis.

Key:

ASAP = As soon as possible.
BOD_5 = Biochemical oxygen demand-5.
BTX = Benzene, toluene, xylene.
COD = Chemical oxygen demand.
EPA = U.S. Environmental Protection Agency.
HDPE = High-density polyethylene.
HNO_3 = Nitric acid.
H_2SO_4 = Sulfuric acid.
L = Liter.
mL = Milliliter.
NA = Not applicable.
NaOH = Sodium hydroxide.
oz. = Ounce.
PCBs = Polychlorinated biphenyls.
SGT = Silica gel treated
SM = Standard Methods for the Examination of Water and Wastewater.
STARS = NYSDEC Spill Technology and Remediation Series (Memorandum No. 1 [1992]).
SVOCs = Semivolatile organic compounds.
TAL = Target Analyze List.
TCL = Target Compound List.
TCLP = Toxicity characteristic leaching procedure.
TDS = Total dissolved solids.
TKN = Total Kjeldahl nitrogen.
TOX = Total Organic Halides.
TRPH = Total recoverable petroleum hydrocarbon.
TSS = Total suspended solids.
VOC = Volatile organic compounds.

For air samples, laboratories will follow cleaning procedures and checking for canisters as outlined in Method TO-15 and the NYSDOH Guidance for Soil Vapor Instrusion. Laboratories are required to certify that containers are clean and provide copies of the certification in the data package.

2.3.2 Sample Preservation and Holding Times

All samples requiring preservation will be collected in containers pre-preserved by the laboratory supplier. If field preservation is necessary, preservation will be immediately after collection and transportation to the site office. A clean, disposable pipette or a premeasured, single-use, glass ampule will be used to transfer liquid preservatives to the sample container. Care will be taken to avoid contact between the pipette or ampule and the sample or sample container. Solid preservatives will be transferred to the sample container using a clean, stainless-steel spoon. The sample preservation will be checked on representative samples by pouring the sample into a clean cup and testing with pH paper to determine if a sufficient amount of preservative has been used. Preserved samples for VOA will be tested on an extra vial at a rate of approximately 10%. Use of additional preservative also will be recorded in the logbook. Field blanks, which require preservation, will be preserved with a volume of reagent equal to the volume of reagent used in the samples that the blanks represent. A list of preservatives and holding times for each type of analysis are indicated in Table 2-1. Additional preservation requirements and holding times for non-target analyses are listed in the NYSDEC ASP.

Samples for soil VOCs will be collected in accordance with Method 5035. The laboratory must supply two pre-tarred VOA vials with 5 mL of deionized water, one pre-tarred vial with methanol, and one 2-ounce container for dry weight analysis (only if no other tests are required). The laboratory also must provide one coring device per sample for collection of a 5-gram plug. Soil samples for VOCs must arrive at the laboratory within 48 hours to be frozen at -7^{o}C.

Reagents used for preservation are reagent-grade and are supplied by the laboratory or approved chemical supplier. The laboratory must maintain traceability records on preservatives in the event of potential field contamination of samples. Each bottle is received from the laboratory and must be clearly labeled with laboratory name, type of chemical, lot number, and expiration date. Field personnel should record the date used in the field, site name, and monitoring firm's project number on the label or in the site logbook. Fresh sample containers and preservatives will be obtained from laboratory stocks prior to mobilization for each sampling event. Preservatives stored on site will be disposed of after use unless containers are sealed and stored under COC in a secure area. No preservatives will be used passed the expiration date.

Sample preservation will be verified at the laboratory at receipt or prior to analysis for VOCs. The preservation or pH will be recorded in the logbook. If samples are improperly preserved, a corrective action form will be submitted to the laboratory project manager for follow-up action. The laboratory will notify the Field Team Leader or Project Manager to implement corrective action in the field.

Methods for the analysis of soils, sediments, or solid matrices for VOCs will be used in conjunction with Method 5035A: Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples. The recommended collection technique for Method 5035A calls for the transfer of a 5-gram aliquot of sample to a tarred empty 40-mL VOA vial. The sample is iced at 4°C for transport to the lab. The laboratory will refrigerate VOA vials at 4°C ± 2°C for 48 hours or less or preserve by freezing at < -7°C within 48 hours of receipt to extend holding time to 14 days.

2.3.3 Sample Handling

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of samples but also prevents any detrimental effects due to the possible hazardous nature of the samples. Regulations for packaging, marking, labeling, and shipping of hazardous materials are promulgated by the DOT in 49 CFR subchapter C. The site monitoring firm shall train all staff responsible for the shipment of samples in these regulations. Procedures for sample packing and shipping are documented in a monitoring firm SOP.

Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids must never be mixed. All sample lids must stay with their original containers;
- Shipping coolers must be partially filled with cushioning materials and ice (when required) to prevent bottles from moving and breaking during shipping;
- Environmental samples are to be cooled. Wet ice packaged in sealable, plastic bags will be used to cool samples during shipping. Ice is not to be used as a substitute for cushioning materials;
- Any remaining space in the cooler should be filled with inert cushioning material, such as bubble wrap. Under no circumstances should material such as sawdust or sand be used;

- A duplicate custody record must be placed in a plastic bag and taped to the inside of the cooler lid. Custody seals are affixed to the sample cooler; and

- All containers for a given sample will be shipped in the same cooler when possible. In cases where samples for volatile analysis would be shipped in several coolers on a single day, VOA vials will be consolidated into a single cooler to minimize the number of required trip blanks.

Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched to the laboratory facility. The SOP procedure will be followed to mark and label sample shipments. A separate COC record must be prepared for each shipping container. The following requirements for shipping containers will be followed.

Sample shipping containers will generally be commercially purchased coolers (e.g., Coleman coolers) or boxes provided from the laboratory for air canisters. Each container will be custody-sealed for shipment, as appropriate. The container custody seal will consist of filament tape wrapped around the package at least twice and custody seals affixed in such a way that access to the container can be gained only by cutting the filament tape and breaking a seal.

Field personnel will make arrangements for transportation of samples to the laboratory. In most cases, samples will be shipped using an overnight express carrier (e.g., Federal Express). Field personnel will provide the laboratory with a shipment schedule and notify them of deviations from planned activities. The field personnel will notify the laboratory of all samples intended for Saturday delivery, no later than 3 p.m. (Eastern Standard Time) on Thursday.

2.3.4 Sample Custody

Formal sample custody procedures begin when the precleaned sample containers leave the laboratory or upon receipt from the container vendor. The laboratory must follow written and approved SOPs for shipping, receiving, logging, and internally transferring samples. Sample identification documents must be carefully prepared so that sample identification and COC can be maintained and sample disposition controlled. Sample identification documents include:

- Field notebooks;

- Sample labels;

- Custody seals; and

- COC records.

The primary objective of COC procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from sampling through completion of all required analyses. A sample is in custody if it is:

- In a team member's physical possession;
- In a team member's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

Field Custody Procedures

Precleaned sample containers will be relinquished by the laboratory to the field monitoring personnel. The Field monitoring personnel will record receipt of the sample containers in the project logbook. The following field custody procedure will be used for collection of samples:

- As few persons as possible should handle samples;
- Coolers or boxes containing cleaned bottles should be sealed with a custody tape seal during transport to the field or while in storage prior to use;
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under COC rules;
- The sample collector will record sample data in the field logbook; and
- The Field Team Leader will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

Chain-of-Custody Record

The COC form must be fully completed in duplicate by the field technician designated by the monitoring firm's Project Manager as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations), the person completing the COC record should note these constraints. The custody record also should indicate any special preservation techniques necessary or

whether samples need to be filtered. Copies of COC records are maintained with the project file.

Custody Seals

Custody seals are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. DOT-approved sample shipping containers are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Upon receipt at the laboratory, the custodian must check and document on a cooler receipt form that seals on boxes are intact.

2.3.5 Laboratory Custody Procedures

All laboratory custody procedures must maintain a system that provides for sample log-in, sign-out and sign-in of samples to and from individual analysts, data storage and reporting, and sample disposal. These procedures must ensure continuous documentation of sample custody from receipt to disposal. Procedures used by the laboratory must meet all NYSDEC requirements. Laboratories must complete a cooler receipt form documenting the temperature and condition of samples on receipt. The form must be provided in the laboratory data package.

The laboratory must submit sample receipt documents for each set of samples received. A sample delivery group (SDG) is defined as a batch of up to 20 samples collected during one calendar week. Samples shipped on Friday will normally conclude an SDG. The sample receipt documents consist of the Sample Receipt file, a pdf of the COC, and a pdf of the laboratory log report showing the tests selected.

The laboratory must implement, practice, and maintain programs for managing waste disposal. The site monitoring firm and NYSDEC markings must be removed from all sample containers prior to disposal. Waste disposal procedures must include use of a certified hauler and meet Federal and State regulations.

2.4 Analytical Method Requirements

Analytical method requirements will be documented in the appropriate work plan or FSP. The specific implementation of analytical methods will be documented in laboratory SOPs. Laboratory SOPs and the QA program will be reviewed and approved as part of the procurement process.

2.4.1 Standard Laboratory Analytical Procedures

Analytical methods in support of NYSDEC activities are referenced in NYSDEC's ASP. The protocol is based on the following methods:

1. 40 CFR Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act;

2. "Standard Methods for the Examination of Water and Wastewater," APHA/AWWA/WEF, 21st ed, 1992;

3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983;

4. "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," 3rd ed, SW-846, 1998, latest update;

5. "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air," 2nd ed, EPA/625/R-96/010b, January 1999;

6. "USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, OLM04.3, 2003or SOM01.2, 2007";

7. "EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration ILM05.4, 2007; and

8. American Society for Testing and Materials (ASTM).

The laboratory must be certified by the NYSDOH ELAP for all analytical methods for which the NYSDOH provides an approval program. Laboratories also must be National Environmental Laboratory Accreditation Program (NELAP) approved by NYSDOH or related accrediting authority.

Table 2-1 lists all analyses that may be performed for NYSDEC projects. Reporting limits for any additional methods will be included in the site-specific QAPP.

The monitoring firm anticipates that laboratories will use the most current method available and/or recommended by EPA. For example, EPA has promulgated the use of Standard Methods references instead of the water method reference listed above. The actual methods for the project will be reviewed and approved as part of the project planning process.

2.5 Quality Control

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. Field QC will include duplicates, trip blanks, field equipment blanks, and miscellaneous field QC samples. Field QC samples will be preserved, documented, and transported in the same manner as the samples they represent. Laboratory-based QC will consist of standards, replicates, spikes, and blanks. Method QC limits for analyses need to be provided by the laboratory or are included in NYSDEC ASP 2005. Quality control limits for any additional methods will be included in the site-specific work plan or FSP.

2.5.1 Field Quality Control Samples

The collection of field QC samples and the conditions, under which the samples were collected, will be documented in the field logbook. Unless otherwise directed by NYSDEC, the field QC samples listed below will be collected and analyzed at the frequency listed in Table 2-2.

Table 2-2 Field Quality Control Guidelines, NYSDEC Projects

QC Sample	Description
Field Duplicate	One per matrix per 20 samples for each analysis.
Field Equipment Blank	One per equipment per 20 samples for each analysis. Only equipment sets that are subject to decontamination require equipment blanks. Dedicated or disposal equipment does not require equipment blanks.
Field Background Samples	Per sampling day for indoor air samples as specified in the guidance for soil vapor intrusion.
Trip Blank	One per shipment for each cooler in which aqueous samples for VOC analysis are shipped or one per shipment batch for air samples. Trip blanks are analyzed for all VOC methods designated for samples. Trip blanks are shipped only for aqueous matrix.

Duplicate Samples

Duplicate samples will be collected at the rate one duplicate per 20 project samples of the same matrix. Duplicate soil samples will be prepared by collecting equal aliquots from the same sample source and placing them in separate sample bottles. Duplicate water samples will be prepared by collecting successive volumes of water and placing them in separate bottles. Duplicate air samples will collected with a tubing splitter. Duplicate samples will be shipped with the samples they represent and will be analyzed in the same manner.

The RPD between the concentration in the original and duplicate sample measures the overall precision of the field sampling and analytical method. Field duplicates are evaluated by using two times the laboratory QC criteria for duplicates (i.e., RPDs of 40% for water and air and 70% for soils). If all other laboratory QC criteria are met, RPD results outside control limits indicate potential matrix effects. Significant deviations in RPD results of field duplicates are assessed to evaluate whether data met all quality objectives for the project.

Trip Blanks

Trip blanks are collected to establish that the transport of sample bottles to and from the field does not result in contamination of the sample from external sources. Trip blanks will be collected for, and in conjunction with, only VOA for aqueous samples. If the 40-milliliter (mL) VOA vials are shipped to the field team by the laboratory sample custodian, a representative number of vials filled with analyte-free water (preserved, capped, and labeled) will accompany the

shipment to and from the laboratory. Trip blanks will be treated in the same manner as the VOA samples they represent and will be taken to representative field sample sites, but remain unopened. Trip blanks will be sent with each sample-shipping container that contains aqueous samples for VOA.

Field Equipment Blanks

Field equipment blanks are blank samples (also called rinsate blanks) designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use and that cleaning procedures between samples are sufficient to minimize cross-contamination. Field equipment blanks will be prepared in the field using an approved water source. Sampling of the water source may also be required if analyte-free water is not obtained from the lab. The field equipment blank will be preserved, documented, shipped, and analyzed in the same manner as the samples it represents. Equipment blanks will be collected at the rate of one sample per day, per equipment set.

An equipment set is all sampling equipment required to collect one sample. For example, one soil sample equipment set may include a stainless-steel bowl, a stainless-steel trowel, and a bucket auger. Samples collected with dedicated or disposable equipment do not require equipment blank samples.

Field equipment and trip blanks serve to demonstrate contamination-free procedures in the field and during sample transport. The goal is for field blanks to be free of contamination. Low-level contamination may be present, but must be less than five times the level found in associated samples. If contamination is greater, the sample results are qualified as non-detect at an elevated-reporting limit. If field blank contaminants are also present in the method blank, or are typical laboratory contaminants, or are not present in project samples, then no further action is required. All other sources of contamination must be investigated as part of the corrective action process. Sample results that do not meet quality objectives after qualification, re-sampling may be required. The QA Officer, Project Chemist, and Project Manager must determine potential changes in field procedures to eliminate contamination sources prior to re-sampling.

Miscellaneous Field QC Samples

This type of QC sampling involves analysis of investigation water sources and monitoring well drilling fluids (if used). Because the water supply source is used in decontamination and well drilling activities, it may be necessary to determine the possibility for the introduction of outside contaminants. Drilling fluids (muds) that are used during well installation may also be analyzed in order to assess the possibility of such constituents affecting groundwater samples.

Field background samples are required for air sampling events. Results of the background sample are used in the assessment process to determine whether contamination is site-related or significant.

2.5.2 Laboratory Quality Control Analyses

Analytical performance is monitored through QC samples and spikes, such as laboratory method blanks, surrogate spikes, QC check samples, matrix spikes, matrix spike duplicates, duplicate samples, and duplicate injections (see Table 2-3). All QC samples are applied on the basis of a laboratory batch. Batches do not exceed 20 samples excluding associated field and laboratory QC samples. The QC samples associated with sample preparation include method blanks, laboratory control samples (LCSs) (also called matrix spike blanks [MSB] by NYSDEC), matrix spikes, and duplicates. The run batch represents all samples analyzed together in the run sequence. The run sequence is typically limited to 24 hours unless defined differently for the analytical method. For some analyses, such as volatile organics, the run batch is equivalent to the preparation batch. The QC samples associated with the run sequence include calibration standards, instrument blanks, and reference standards. Unless otherwise directed by NYSDEC staff, the laboratory QC samples listed below will be collected and analyzed at the frequency listed in Table 2-3.

Table 2-3 Laboratory Quality Control Sample Guidelines, NYSDEC Projects

QC Sample	Description
MB	One per matrix per preparation batch for each analysis.
LCS/MSB	One per matrix per preparation batch for each analysis. The LCS/MSB must contain all target analytes of concern at the site.
Surrogate Spikes	All samples analyzed for organic methods.
Internal Standards	All samples analyzed by GC/MS methods.
MS/MSD	One per matrix per SDG for each analysis. The spike solution must contain a broad range of the analytes of concern at the site. The overall frequency of MS/MSD on project samples must be at least one set per 20 samples.
MS/MD	One per matrix per SDG for metals and general chemistry methods. The spike solution must contain a broad range of analytes of concern at the site. The overall frequency of MS/MD on the project samples must be at least one set per 20 samples.
Serial Dilution/Post Digestion Spike	All samples analyzed for metals.

Key:
SDG = Sample Delivery Group.
LCS = Laboratory Control Samples.
MSB = Matrix Spike Blank.
MS/MD = Matrix Spike/Matrix Duplicate.
MS/MSD = Matrix Spike/Matrix Spike Duplicate.
MB = Method Blank.
TAL = Target Analyte List.

Instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving detection limits or associated QC target criteria. In such instances, data will not be rejected *a priori* but will be examined on a case-by-case basis. The laboratory will report the reason for deviations from these detection limits or noncompliance with QC criteria in the case narrative.

Laboratory Method Blank

Laboratory method blanks serve to demonstrate a contamination-free environment in the laboratory. The goal is for method blanks to be free of contamination. Low-level contamination may be present, but must be less than the reporting limit. If contamination is greater, samples are reanalyzed. If contaminants are present in the method blank but not in project samples, no further action is required. All sources of contamination that are not common laboratory contaminants as defined in the method SOPs must be investigated as part of the corrective action process. Sample results must not be blank subtracted unless specifically required by the analytical method.

Surrogate Standards

Surrogate recoveries must be within QC criteria for method blanks and LCSs to demonstrate acceptable method performance. If surrogate recoveries are outside QC criteria for method blanks or LCSs, corrective action is required and the Project Chemist should be notified. Surrogate recoveries in the samples indicate the method performance on the particular sample matrix. Surrogate recoveries that are outside QC criteria for a sample indicate a potential matrix effect. Matrix effects must be verified based on review of recoveries in the method blank or LCS, sample reanalysis, or evaluation of interfering compounds. Sample clean-up procedures are required by the NYSDEC ASP must be implemented to alleviate potential matrix problems.

Laboratory Control Sample

LCS recoveries must be monitored on control charts for all non-CLP methods. Laboratory QC criteria must be established for each method and matrix using a minimum of 30 points. QC criteria should be updated annually for all non-CLP methods. The LCS recovery must be within the control limits to demonstrate acceptable method performance. Sporadic marginal failures of a few target analytes reported when greater than five target analytes are required are allowed as part of the data review guidance. If LCS recoveries are outside QC criteria for more than a few target analytes, recoveries are significantly low, or the compounds were detected in the samples, then corrective action is required. After corrective action is complete, sample re-analysis is required for failed parameters. If LCS recoveries exceed the QC criteria, and that parameter is not found in any samples, re-analysis is not necessary. For any other deviations from LCS control limits that can not be

resolved by sample re-analysis within holding times, the Project Chemist must be notified immediately. If critical samples are affected, the Project Manager may determine that re-sampling is required.

Matrix Spike Sample

MS recoveries are a measure of the performance of the method on the sample being analyzed. Field and trip blanks must not be chosen for spiking. MS recoveries outside the control limits applied to the LCS indicate matrix effects. Sample clean-up procedures may be warranted for samples with severe matrix effects. The laboratory should notify the Project Chemist of these instances to determine an appropriate corrective action.

Matrix Spike Duplicate Sample

The MSD sample is commonly prepared in conjunction with the MS sample. The MSD is prepared from a separate portion of the sample and processed with the same additions as the MS. The MSD is prepared for methods that do not typically show concentrations of target analytes above MDLs, such as organic methods. The RPD between the recoveries in the MS and MSD measures the precision of the analytical method on actual project samples. QC criteria for RPDs are 20% for waters and 35% for soils unless the laboratory provides additional statistical criteria.

Duplicate Sample

The duplicate is prepared for methods that typically show concentrations of target analytes above MDLs, such as metals and wet chemistry methods. The RPDs between recoveries in the original and duplicate measures the precision of the analytical method on the actual project samples. QC criteria for RPDs are 20% for waters and 35% for soils unless the laboratory provides additional statistical criteria.

If all other QC criteria are met, RPD results outside control limits indicate potential matrix effects. The laboratory should investigate significant deviations in the RPD results by observing the sample to determine any visual heterogeneity or reviewing sample chromatograms for matrix interference. If visual observation does not indicate a potential problem, the sample may be reanalyzed. Potential matrix effects are reported in the case narrative.

Instrument Blanks

Instrument or reagent blanks are analyzed in the laboratory to assess laboratory instrument procedures as possible sources of sample contamination. Instrument blanks are part of the laboratory corrective action if method blanks show contamination or the analyst suspects carryover from a high concentration sample. Instrument blank results are reported on a laboratory corrective action form.

QC Check Standards

A QC check standard is obtained from a different source or at a minimum a lot different from that of the calibration standard. A check standard result is used to validate an existing concentration calibration standard file or calibration curve. The check standard provides information on the accuracy of the instrumental analytical method, independent of various sample matrices. Check standards are analyzed with each new calibration curve.

Internal standard area counts for water and solid sample analysis for all samples must be in the inclusive range of 50% to 200%, and retention time must not marry more than +/- 30 seconds of its associated 12-hour calibration standard (i.e., opening Continuing Calibration Verification or mid-point standard from Initial Calibration).

The serial dilution analysis (a five-fold dilution) must agree within a 10% difference of the original determination after correction for the dilution if the analyte concentration is sufficiently high (concentration in the original sample is >50 times [50x] the MDL).

The post-digestion spike (%R) must be within the acceptance limits of 75% to 125%. However, spike recovery limits do not apply when the sample concentration is greater than 4x the spike added.

Other Laboratory QC Samples

The laboratory performs analysis of other QC samples or standards, depending on the analytical method. Method-specific QC samples or standards include internal standard spikes for gas chromatography/mass spectrometry (GC/MS) methods; post-digestion spikes and serial dilutions for metals analysis; and interference check samples (ICSs) for ICP analysis.

Blind QC Check Samples

Types of blind QC check samples include external performance evaluation (PE) samples provided by an outside certifying agency and internal QC samples submitted for routine analysis by the laboratory QA officer. The laboratory must pass NYSDOH samples as part of the approval process. If methods are used that are not included in NYSDOH approval process, blind QC samples may be submitted to the laboratory to evaluate method performance.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance

All laboratory and field instruments and equipment used for sample analysis must be serviced and maintained only by qualified personnel. Laboratory instrument maintenance procedures will be evaluated to verify that there will be no impacts on analysis of project samples due to instrument malfunction. For example, the

laboratory must have duplicate instrumentation and/or major laboratory instruments (e.g., GC/MS, ICP, atomic absorption spectroscopy [AAS]) maintained under service agreements with the manufacturer that require rapid respond by manufacturer-approved service agents.

Field instruments will be rented through approved suppliers that have manufacturer-approved maintenance programs.

2.6.1 Field Equipment Maintenance

Field equipment will be checked upon receipt to verify that instruments are in working condition and that the rental company provided appropriate calibration records or certifications. On-site operation will be performed in accordance with manufacturer manuals. If any problems occur, the instrument will be replaced immediately. Equipment purchased for the contract will be maintained in accordance with manufacturer guidance.

2.6.2 Laboratory Equipment Maintenance

The laboratory must maintain a stock of spare parts and consumables for all analytical equipment. Routine preventive maintenance procedures should be documented in SOPs. Maintenance performed on each piece of equipment must be documented in a maintenance logbook. Daily checks of the laboratory deionized water and other support systems are required. The laboratory must operate backup instrumentation for most of its analytical equipment in the event of major instrument failure or have an alternative approached to ensure analytical work proceeds within holding times with no adverse impacts on data quality.

2.7 Instrument/Equipment Calibration and Frequency

All instruments and equipment used during sampling and analysis will be operated and calibrated according to the manufacturer's guidelines and recommendations, as well as criteria set forth in applicable analytical methodology references. Personnel properly trained in these procedures will perform operation and calibration of all instruments. Documentation of all field maintenance and calibration information will be maintained in the field logbook. Table 2-4 lists typical monitoring equipment used during fieldwork. This equipment is representative of instruments typically required for NYSDEC projects. All equipment used for the NYSDEC projects will be NYSDEC-owned or rented. All field personnel receive annual refresher training on the field operation of all health and safety related equipment, which includes calibration procedures. Brief descriptions of calibration procedures for major field instruments are listed on Table 2-4.

Table 2-4 General Field Equipment and Calibration Procedures

Instrument or Equipment	Description[a]	Field Calibration Procedure	Acceptability/ Performance Criteria	Responsible Personnel
Organic Vapor Analyzer (OVA)	Flame Ionization Detector to provide continuous data on organic vapor concentrations. Unit must be Class I, Division 1, Grade A,B,C,D. Unit must have rechargeable battery, range of 0 to 1,000 ppm, and ultra-high purity hydrogen as fuel source.	Units are factory calibrated to remain with performance specification for an excess of 6 months. During field use, a carbon filter is used with the OVA to distinguish methane from other organics. The unit is checked daily with calibration gas to ensure the response is consistent. If needed, the unit will be re-calibrated to manufacturer specifications. When the OVA is used to screen samples (except samples for headspace analysis), periodic ambient air readings will also be recorded in the logbook.	A carbon filter must remove sources of organic vapors other than methane (i.e., marker). Instrument must detect organic vapors without filter. Response should be checked daily with calibration gas. The accuracy will depend on the application.	Site Safety Officer, Project Geologist
O_2 Explosimeter	Gas monitor designed to simultaneously monitor areas for oxygen deficiency and dangerous levels of combustible gas. Units must be equipped with sample pumps and hoses to measure gases in a confined space. Range O_2 - 0 to 25%, LEL - 0 to 100%, H_2S - 0 to 200 ppm, and CO - 0 to 999 ppm. Not all units have the additional capability to detect hydrogen sulfide or H_2S or carbon dioxide.	Procedures for field calibration of the O_2/explosimeter are as follows: ■ Inspect instrument to ensure entry and exit ports are clear; ■ Turn the switch to ON position; ■ Allow the meters to stabilize and then press the reset button; ■ Check the battery level; ■ Calibrate the oxygen meter to 20.8% by using the calibrate knob; ■ Adjust the explosimeter to zero by using the zero knob; and ■ Check alarm levels by adjusting the calibrate knob for oxygen levels and the zero knob for explosimeter levels and note the readings when the alarm sounds. Return readings to normal and depress the reset button.	Alarm must sound during calibration procedure. Battery must have sufficient charge for operation. Blocking the sample line probe and observing the drop of the flow indicator float checks flow system. If flow system is not functioning, return unit for repairs.	Site Safety Officer, Project Geologist

Table 2-4 General Field Equipment and Calibration Procedures

Instrument or Equipment	Description[a]	Field Calibration Procedure	Acceptability/ Performance Criteria	Responsible Personnel
pH/Conductivity, Temperature, Dissolved Oxygen (DO), Oxidation Reduction (REDOX) Meter	Meter designed for field use with battery operation. The unit must contain separate pH, temperature, conductivity, DO, and ORP probes in one unit.	Before use, pH, specific conductance, DO, and ORP probes need to be calibrated or tested for responsiveness. The pH probe will be calibrated first. This is done by placing the probe in pH 7, then pH 4, standard solutions and adjusting the pH calibration knobs until the correct measurement is obtained. The ORP probe is then calibrated with the ORP standard solution (Zobell), and the DO probe is checked in accordance with manufacturer guidelines. The probes should be rinsed with deionized water between each calibration solution and following calibration. Used calibration solution is to be discarded. Finally, the conductivity probe is checked with a solution of known conductivity.	Turbidity and DO ± 10% pH ± 0.01 pH Conductivity at ± 2% FSD The instrument will be checked with a pH standard every 4 hours and at the end of the sampling day. If the response is greater than 0.2 units more or less than the standard, complete calibration will be conducted.	Project Geologist, Sampler
Turbidity Meter	Nephelometer designed for field use with battery operation. Range 0.01 to 1,000 NTU.	The unit is factory calibrated. Field procedures involve checking the unit's responsiveness at least once a day using factory supplied standards. The responsiveness should be checked on the 0 to 10 range, 0 to 100 range, and 0 to 1,000 range.	± 10%	Sampler

Table 2-4 General Field Equipment and Calibration Procedures

Instrument or Equipment	Description[a]	Field Calibration Procedure	Acceptability/ Performance Criteria	Responsible Personnel
Photoionization detector (PID)	The PID is a portable, non-destructive trace gas analyzer. Units for site characterization must have a range of 0 to >2,000 ppm and a 10.6 or 11.7 eV lamp (e.g., MiniRAE 2000). Units for indoor air monitoring must have a range of 1 ppb to 2,000 ppm and a 10.6 eV lamp (e.g., ppb RAE Plus). Calibration check gas (e.g., isobutylene) must be provided with unit.	In the field, PIDs will be calibrated at the start of each field event by the manufacturer. Initial calibration must be verified by a certificate of calibration from the rental company or field calibration is required. There is no field calibration for a Mini-Rae 2000. If a significant change in weather occurs during the day (i.e., change in humidity or temperature) or if the unit is turned off for an extended period, then there is a field test, called a Bump Test. It consists of having the unit sniff 100 ppm cal gas and determine the reading. If the unit is reading 100 ppm or close to it, then it is OK. If not, depending on how far off it is, either dry out the unit on a heater (due to potential fogging of the lamp), or send the unit back to the rental company for in-house calibration.	Meter must give consistent background readings.	Site Safety Officer, Project Geologist
Global Positioning System (GPS)	Trimble GeoXT or GeoXH handheld GPS units.	Trimble GeoXT/GeoXH handheld GPS units do not require field calibration. To verify accuracy, the field team will collect three divergent GPS location points at nearby, known, fixed structures such as bridges, road intersections, or large buildings.	Horizontal accuracy to less than 1 meter. Not applicable for vertical measurements.	FTL
	Differential GPS with Real Time Kinematic processing	For survey grade work, a first order benchmark (horizontal, vertical, or both depending on the requirements of the work) is required. Therefore, no calibration is necessary.	Horizontal and vertical accuracy of ±2 centimeters.	Subcontractor

[a] Description is for typical equipment; equivalent units may be used.

Key:
ev = Electron volts.
ppm = Parts per million.

The monitoring firm requires laboratories to use the most current method available for calibration criteria. For example, EPA no longer allows the use of the grand mean to evaluate calibration linerity for organic methods. The monitoring firm requires that the most stringent method criteria be met for all compounds of concern at site. Unless modified by the method, the monitoring firm requires at least a five point curve for all calibrations for organics and a minimum of three calibration points for inorganics; exclusion of points is not allowed to meet criteria without technical justification. Any manual integration performed for calibrations needs to be documented with the rationale and included in the data package. Manual integrations of internal standards or surrogates in calibrations are not allowed.

2.8 Inspection/Acceptance of Supplies and Consumables

Measures are established in the monitoring firm's corporate QMP to assure that purchased material, equipment, and services whether purchased directly or through contractors or subcontractors conform to procurement documents. Documentation regarding the purchase of material, equipment, and services is prepared, reviewed, and approved in accordance with requirements set forth in the QMP and monitoring firm subcontracting procedures.

2.9 Non-Direct Measurements

For data acquired from non-direct measurement sources include the following:

- Physical information such as descriptions of sampling activities and geologic logs;
- State and local environmental agency files;
- Reference computer databases and literature files; and
- Historical reports on a site and subjective information gathered through interviews.

Data from non-direct measurements will be reviewed and used as indicated in the work plan. Data from all non-direct measurement sources are stored as indicated in Section 1.6.

2.10 Data Management

Data management procedures track samples and results from work plan generation to the final report. The field data include approved work planning tables, Global Positioning System (GPS) data, subcontract surveyor data, labels, field sampling forms, COC forms, and logbooks. The field team leader will review all field data for accuracy.

Electronic data will be provided in accordance with the most recent version of EPA Region 2's standardized electronic data deliverable (EDD) format. The format is based on the Multimedia Electronic Data Deliverable, or MEDD format. Further information on MEDD is available at the Web site http://www.epa.gov/region02/superfund/medd.htm. If required for the project, the laboratory also may provide an alternative EDD consistent with the Corporate EDD or other approved format.

The monitoring firm's site-specific technical team will process the EDD to verify that criteria established in this QAPP (see Appendix A) are met. The Project Chemist will review all laboratory and field data to verify the results against the hard copy and check for transcription errors. The Project Chemist will verify qualifiers added by data processing and add any data qualifiers. The individual SDG EDD files will be processed to a centralized data management system to store all reviewed and approved data. Data that will appear on data tables for the report will be generated from the centralized database, which will serve as the central, protected data source for all data handling operations.

The central database will be stored in a secure area on monitoring firm's network with access limited to data management specialists designated by the Project Manager. Data users may enter additional electronic data such as risk-based criteria for comparison of results. This data will be stored in separate tables in the database and linked to the actual results. Any data from outside sources will include a description of the data, a reference to the source, and the date updated. Outside data will be checked prior to use to verify that current values are used.

3 Assessment and Oversight

The monitoring firm's assessment and oversight procedures will be implemented in accordance with the QMP. The QMP outlines general roles and responsibilities for the project team.

3.1 Assessment and Response Actions

The monitoring firm's overall assessment activities include management assessments, development of SOPs, and performance evaluations. Management assessments include weekly meetings and conference calls to evaluate project readiness and staff utilization. Assignment of qualified personnel, maintenance of schedules and budgets, and quality of project deliverables are verified as part of these assessments. The development of SOPs and performance evaluations are used to provide trained and qualified personnel for the project.

The monitoring firm's technical assessment activities include peer review, data quality reviews, and technical system audits (i.e., laboratory and field). Procedures for assessment and audit of data quality are described in Section 4 of this QAPP. Procedures for peer review and technical assessments are summarized briefly below.

Both overall and direct technical assessment activities may result in the need for corrective action. The monitoring firm's approach to implementing a corrective action response program for both field and laboratory situations is summarized briefly below. The NYSDEC QA Officer has stop work authority on all NYSDEC projects that may have negative quality impacts prior to completion of corrective actions.

3.1.1 Peer Review

The monitoring firm implements peer review for all project deliverables including work plans, QAPPs, draft and final reports, and technical memoranda. The peer review process provides for a critical evaluation of the deliverable by an individual or team to determine if the deliverable will meet established criteria, quality objectives, technical standards, and contractual obligations. The Project Manager will assign peer reviewers, when the publications schedule is established. The publications staff will be responsible for ensuring all peer reviewers participate in

the review process and approve all final deliverables. For technical memoranda and other project documents, the Project Manager will be responsible for obtaining principal review and approval.

3.1.2 Technical Systems Assessments

The entire project team is responsible for ongoing assessment of the technical work performed by the team, identification of nonconformance with the project objectives, and initiation, implementation and documentation of corrective action. Independent performance and systems audits are technical assessments that are a possible part of the QA/QC program. The following describes types of audits conducted, frequency of these audits, and personnel responsible for conducting audits.

Field Audits

Field audits are performed under the direction of the QA Officer. The need for field audits will be determined during project planning and indicated in the work plan. Field audits will be documented on field audit checklists. Field audits will be typically performed during the early field programs.

Field Inspections

The Project Manager will be responsible for inspecting all field activities to verify compliance of activities with project plans.

Laboratory Audits

The laboratory must implement a comprehensive program of internal audits to verify compliance of their systems with SOPs and QA manuals.

NYSDOH must certify the laboratory and will perform external systems audits at an approximate frequency of once a year. External audits include reviews of analytical capabilities and procedures, COC procedures, documentation, QA/QC, and laboratory organization. These audits also include analysis of blind PE samples.

The QA Officer or designee may also audit laboratories. These audits are typically performed to verify laboratory capabilities and implementation of any complex project requirements or in response to a QC nonconformance identified as part of the data review process.

3.1.3 Corrective Action

Corrective actions will be implemented as needed. In conjunction with the QA Officer and Laboratory QA Coordinator, the Project Manager is responsible for initiating corrective action and implementing it in the field and office, and the laboratory project manager is responsible for implementing it in the laboratory. It is their combined responsibility to see that all sampling and analytical procedures are followed as specified and that the data generated meet the prescribed ac-

ceptance criteria. Specific corrective actions necessary will be clearly documented in the logbooks or analytical reports.

Field Situations

The need for corrective action in the field may be determined by technical assessments or by more direct means such as equipment malfunction. Once a problem has been identified, it may be addressed immediately or an audit report may serve as notification to project management staff that corrective action is necessary. Immediate corrective actions taken in the field will be documented in the project logbook. Corrective actions may include, but are not limited to:

- Correcting equipment decontamination or sample handling procedures if field blanks indicated contamination;
- Recalibrating field instruments and checking battery charge;
- Training field laboratory personnel in correct sample handling or collection procedures; and
- Accepting data with an acknowledged level of uncertainty.

After a corrective action has been implemented, its effectiveness will be verified. If the action does not resolve the problem, appropriate personnel will be assigned to investigate and effectively remediate the problem. Corrective actions recommended by NYSDEC personnel will be addressed in a timely manner.

Laboratory Situations

Out-of-control QC data, laboratory audits, or outside data review may determine the need for corrective action in the laboratory. Corrective actions may include, but are not limited to:

- Reanalyzing samples, if holding times permit;
- Correcting laboratory procedures;
- Recalibrating instruments using freshly prepared standards;
- Replacing solvents or other reagents that give unacceptable blank values;
- Training additional laboratory personnel in correct sample preparation and analysis procedures; and
- Accepting data with an acknowledged level of uncertainty.

The laboratory corrective actions must be defined in analytical SOPs. Any deviations from approved corrective actions must be documented and approved by the Project Chemist.

Whenever corrective action is deemed necessary by the Project Chemist or NYSDEC technical staff, the laboratory project manager will ensure that the following steps are taken:

- The cause of the problem is investigated and determined;
- Appropriate corrective action is determined;
- Corrective action is implemented and its effectiveness verified by the laboratory QA officer; and
- Documentation of the corrective action verification is provided to the Project Chemist and NYSDEC staff in a timely manner.

3.2 Reports to Management

For reports to management include the following:

- **Audit Reports** - Audit reports are prepared by the audit team leader immediately after completion of the audit. The report will list findings and recommendations and will be provided to the Project Manager and QA Officer.
- **Data Usability Summary Report** - A DUSR will be completed by the Project Chemist and provided to the NYSDEC technical staff in the appendix of the report. Impacts on the usability of data will be tracked by adding qualifiers to individual data points as described in Section 4.

Upon completion of a project sampling effort, analytical and QC data will be included in a comprehensive technical report that summarizes field activities and provides a data evaluation. A discussion of the validity of results in the context of QA/QC procedures will be made and the DUSR will be provided.

Serious analytical problems will be reported immediately to NYSDEC personnel. Time and type of corrective action (if needed) will depend on the severity of the problem and relative overall project importance. Corrective actions may include altering procedures in the field, conducting an audit, or modifying laboratory protocol.

4 Data Validation and Usability

The monitoring firm will implement procedures for data validation and usability described below. These procedures will be adapted, if necessary, to meet project-specific requirements as determined in the work plan or FSP. A generic data usability validation checklist report form is provided in Appendix A.

4.1 Data Review, Validation, and Verification Requirements

All data generated will be reviewed by comparing accuracy and precision results for the QC samples to QC criteria listed in NYSDEC ASP 2005. The following types of data will be reviewed:

- Analytical reporting limits and target compounds will be compared to limits listed in Appendix A or site-specific QAPP;
- Holding times will be verified against Table 2-1;
- QC summary data for surrogates, method blanks, LCS, and MS/MSD samples will be compared to criteria listed in Appendix A or the site-specific QAPP;
- Field QC results for duplicates and blanks will be compared to criteria listed in Section 2.5.1;
- Calibration summary data will be checked by the laboratory to verify that all positive results for target compounds were generated under an acceptable calibration as defined by the analytical method. Any deviations will be noted in the case narrative and reviewed by the Project Chemist;
- Field data such as sample identifications and sample dates will be checked against the laboratory report; and
- Any raw data files from the field and laboratory will not be reviewed unless there is a significant problem noted with the summary information.

4.2 Validation and Verification Methods

The data review scheme for analytical results from the receipt of the analytical data through the validated report is described below. The laboratory is responsible for performing internal data review. The laboratory data review must include 100% analyst review, 100% peer review, and 100% review by the laboratory project manager or designated QC reviewer to verify that all project-specific requirements are met. All levels of laboratory review must be fully documented and available for review if requested or if a laboratory audit is performed.

After receipt from the laboratory, project data will be validated using the following steps:

Evaluation of Completeness

The Project Chemist checks the electronic files for compliance with required format and the project target compounds and units. If errors in loading are found, the EDD files will be returned to the laboratory and the Project Chemist will request resubmission via SubLab. The Project Chemist also verifies that the laboratory information matches the field information and that the following items are included in the data package:

- COC forms and laboratory sample summary forms;
- Case narrative describing any out-of-control events and summarizing analytical procedures;
- Data report forms (i.e., Form I);
- QA/QC summary forms; and
- Chromatograms documenting any QC problems.

If the data package is incomplete, the Project Chemist will request resubmission. The laboratory must provide all missing information within one day.

Evaluation of Compliance

The Project Chemist will review all processed files and add data qualifiers for outliers. If QC data are provided in the EDD, the results will be used to verify compliance electronically. If no QC data are provided in the EDD, the reports will be checked manually. Additional compliance checks on representative portions of the data are briefly outlined below:

- Review chromatograms, mass spectra, and other raw data if provided as back-up information for any apparent QC anomalies;

- Review of calibration summaries or any other QC samples not provided in the EDD by the laboratory;

- Ensure that all analytical problems and corrections are reported in the case narrative and that appropriate laboratory qualifiers are added;

- For any problems identified, review concerns with the laboratory, obtain additional information if necessary, and check all related data to determine the extent of the error;

- Project chemists will follow qualification guidelines in EPA Region 2 data validation SOPs or *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review,* USEPA 540-R-08-01 (June 2008) or *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review,* USEPA 540-R-10-011 (January 2010), but will use the specific method criteria for evaluation. The DUSR will be completed as specified in NYSDEC *DER-10/Technical Guidance for Site Investigation and Remediation; Appendix 2B, Guidance for Data Deliverables and the Development of Data Usability Summary Reports* (May 2010); and

- Monitoring firm data validation criteria are incorporated into checklists for some methods.

Data Review Reporting

The Project Chemist will perform the following reporting functions:

- Alert the Project Manager to any QC problems, obvious anomalous values, or discrepancies between the field and laboratory data, that may impact data usability; and

- Discuss QC problems in a DUSR for each laboratory report. DUSR will include a short narrative and print out of qualified data;

- Prepare analytical data summary tables of qualified data that summarize those samples and analytes for which detectable concentrations were exhibited including field QC samples; and

- At the completion of all field and laboratory efforts, summarize planned versus actual field and laboratory activities and data usability concerns in the technical report.

4.3 Reconciliation with User Requirements

For routine assessments of data quality, the monitoring firm will implement the data validation procedures described in Section 4.2 and assign appropriate data qualifiers to indicate limitations on the data. The Data Validation Chemist will be responsible for evaluating precision, accuracy, representativeness, comparability, and completeness of data using procedures described in Section 2.5 of this QAPP. Any deviations from analytical performance criteria or quality objectives for the project will be documented in the DUSR provided to the data users for the project.

The QA Officer or Project Chemist will work with the final users of the data in performing data quality assessments. The data quality assessment may include some or all of the following steps:

- Data that are determined to be incomplete or not usable for the project will be discussed with the project team. If critical data points are involved which impact the ability to complete project objectives, data users will report immediately to the Project Manager. The Project Manager will discuss resolution of the issue with NYSDEC technical staff and implement necessary corrective actions (for example re-sampling);

- Data that are non-detect but have elevated reporting limits due to blank contamination or matrix interference will be compared to screening values. If reporting limits exceed the screening values, then results will be handled as incomplete data as described above; and

- Data that are qualified as estimated will be used for all project decision making. If an estimated result is close to a screening value, then there is uncertainty in any conclusions as to whether the result exceeds the screening value. The data user must evaluate the potential uncertainty in developing recommendations for the site. If estimated results become critical data points in making final decisions on the site, the Project Manager and NYSDEC technical staff should evaluate the use of the results and may consider the data point incomplete.

The assessment process involves comparing analytical results to screening values and background concentrations to determine if the contamination present is site-related (i.e., above background levels) or significant (i.e., above screening values). Additional data assessment may be performed on a case-by-case basis.

A Data Usability Summary Report Model

Data Usability Summary Report	Project:
Date Completed:	Completed by:

The analytical data provided by the laboratory were reviewed for precision, accuracy, and completeness per NYSDEC Division of Environmental Remediation Guidance DER-10 Technical Guidance for Site Investigation and Remediation; Appendix 2B, Guidance for Data Deliverables and the Development of Data Usability Summary Reports (May 2010). Specific criteria for QC limits were obtained from the project QAPP. Compliance with the project QA program is indicated in the checklist and tables. Any major or minor concerns affecting data usability are listed below. The checklist and tables also indicate whether data qualification is required and/or the type of qualifier assigned.

Reference:

Table 1 Sample Summary Tables from Electronic Data Deliverable

Work Orders, Tests and Number of Samples included in this DUSR

General Sample Information	
Do Samples and Analyses on COC check against Lab Sample Tracking Form?	
Did coolers arrive at lab between 2 and 6°C and in good condition as indicated on COC and Cooler Receipt Form?	
Frequency of Field QC Samples Correct? Field Duplicate - 1/20 samples Trip Blank - Every cooler with VOCs waters only Equipment Blank - 1/ set of samples per day?	
All ASP Forms complete?	
Case narrative present and complete?	
Any holding time violations (See table below)?	

Insert Holding time table below.

The following tables are presented at the end of this DUSR and provided summaries of results outside QC criteria.

- Method Blanks Results (Table 2)
- Surrogates Outside Limits (Table 3)
- MS/MSD Outside Limits (Table 4)
- LCS Outside Limits (Table 5)
- Re-analysis Results (Table 6)
- Field Duplicate Results (Table 7)

Go to Tables List

Data Usability Summary Report	Project:
Date Completed:	Completed by:

Volatile Organics and Semi-volatile Organics by GCMS	
Description	**Notes and Qualifiers**
Any compounds present in method, trip and field blanks (see Table 2)?	
For samples, if results are <5 times the blank or < 10 times blank for common laboratory contaminants then "U" flag data. Qualification also applies to TICs.	
Surrogate for method blanks and LCS within limits?	
Surrogate for samples and MS/MSD within limits? (See Table 3). All samples should be re-analyzed for VOCs? Samples should re-analyzed if >1 BN and/or > AP for BNAs is out. Matrix effects should be established.	
Laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples?	
MS/MSD within QC criteria (see Table 4)? If out and LCS is compliant, then J flag positive data in original sample due to matrix?	
LCS within QC criteria (see Table 5)? If out, and the recovery high with no positive values, then no data qualification is required.	
Do internal standards areas and retention time meet criteria? If not was sample re-analyzed to establish matrix (see Table 6)?	
Is initial calibration for target compounds <15 %RSD or curve fit?	
Is continuing calibration for target compounds < 20.5%D.	
Were any samples re-analyzed or diluted (see Table 6)? For any sample re-analysis and dilutions is only one reportable result by flagged?	
For TICs are there any system related compounds that should not be reported?	
Do field duplicate results show good precision for all compounds except TICs (see Table 7)?	

Pesticide and PCBs by GC/ECD	
Description	**Notes and Qualifiers**
Any compounds present in method and field blanks as noted on Table 2?	
For samples, if results are <5 times the blank then "U" flag data.	
Surrogate for method blanks and LCS within limits?	
Surrogate for samples and MS/MSD within limits? (See Table 3). Matrix effects should be established.	
Laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples?	
MS/MSD within QC criteria (see Table 4)? If out and LCS is compliant, then J flag positive data in original sample due to matrix?	
LCS within QC criteria (see Table 5)? If out, and the recovery high with no positive values, then no data qualification is required.	
Is initial calibration for target compounds <15 %RSD or curve fit?	
Is continuing calibration for target compounds < 15.5%D.	

Data Usability Summary Report	Project:
Date Completed:	Completed by:

Pesticide and PCBs by GC/ECD	
Description	**Notes and Qualifiers**
Were any samples re-analyzed or diluted (see Table 6)? For any sample re-analysis and dilutions is only one reportable result by flagged?	
Spot check retention time windows and second column confirmations as complete.	
Do field duplicate results show good precision for all compounds (see Table 7)?	

Metals by ICP and Mercury by CVAA	
Description	**Notes and Qualifiers**
Any compounds present in method and field blanks as noted on Table 2?	
For samples, if results are <5 times the blank then "U" flag data.	
Laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples?	
MS/MSD within QC criteria (see Table 4)? QC limits are not applicable to sample results greater than 4 times spike amount. All N flagged data for MS are flagged J as estimated.	
Were elements recovered ≤30%? If so, “R” flag associated NDs on Form 1's.	
LCS within QC criteria (see Table 5)? If out, and the recovery high with no positive values, then no data qualification is required.	
Is there one serial dilution per 20 samples? Flag all data reported with an “E” as “J”.	
Spot check ICS recoveries 80-120%. Contact lab.	
Spot check ICV 95-105%. Contact lab.	
Spot check CCV 90-110% or 80-120% for Hg. Contact lab.	
Do field duplicate results show good precision for all compounds (see Table 7)?	

Data Usability Summary Report	Project:
Date Completed:	Completed by:

General Analytical Methods	
Description	**Notes and Qualifiers**
Any compounds present in method and field blanks as noted on Table 2?	
For samples, if results are <5 times the blank then "U" flag data.	
Laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples?	
MS/MSD within QC criteria (see Table 4)? QC limits are not applicable to sample results greater than 4 times spike amount.	
LCS within QC criteria (see Table 5)? If out, and the recovery high with no positive values, then no data qualification is required.	
Do field duplicate results show good precision for all compounds (see Table 7)?	

Summary of Potential Impacts on Data Usability
Major Concerns
Minor Concerns

Table 2 - List of Positive Results for Blank Samples

Table 2A - List of Samples Qualified for Method Blank Contamination

Table 2B - List of Samples Qualified for Field Blank Contamination

Table 3 - List of Samples with Surrogates outside Control Limits

Table 4 - List MS/MSD Recoveries and RPDs outside Control Limits

Table 5 - List LCS Recoveries outside Control Limits

Table 6 –Samples that were Reanalyzed

Table 7 – Summary of Field Duplicate Results

Key:
A = Analyte
NC = Not Calculated
ND = Not Detected
PQL = Practical Quantitation Limit
RPD = Relative Percent Difference
T = Tentatively Identified Compound

APPENDIX I – SITE INSPECTION FORM

SITE INSPECTION FORM

I. SITE INFORMATION	
Site Name: Former Hexagon Laboratories	**Date of Inspection:**
Location: 3536 Pear Tree Ave, Eastchester, Bronx, NY	**NYSDEC Site No.:** 2-03-003
Inspector (Firm/Individual):	**Weather/Temperature:**
Attachments: Sample results ☐	Annotated site map ☐ Other _____

Item	Condition			Comments
	Good	Needs Maintenance	N/A	
II. GENERAL SITE CONDITIONS				
Warning/instruction signs				
Litter				
Vandelism				
Vegetative infestation				
III. ACCESS CONTROLS				
Fencing				
Gates				
Locks				
IV. SOIL COVER SYSTEM				
Gravel layer				
Geotextile layer				
Sand layer				
V. GROUNDWATER MONITORING WELLS				
Flush mount well covers				
Lockable J plugs/locks				
Overburden casings/seal				
Functionality				

VI. OVERALL OBSERVATIONS