



October 27, 2004

Mr. John Spellman, P.E.
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 11th Floor
Albany, New York 12233-7017

**RE: Final Remedial Investigation Work Plan
Clark Street Former Manufactured Gas Plant
Auburn, New York**

Dear Mr. Spellman:

On behalf of New York State Electric & Gas Corporation (NYSEG), URS is pleased to present the New York State Department of Environmental Conservation (NYSDEC) with three copies of *the Final Remedial Investigation Work Plan*, dated October 2004 for the above-referenced site. One copy was forwarded to both Mr. James Burke (NYSDEC – Syracuse) and Ms. Wendy Kuehner (New York State Department of Health – Troy).

NYSEG and URS appreciate the NYSDEC's assistance with this project. If you have any questions or comments, please contact Mr. John Ruspantini of NYSEG at (607) 762-8787.

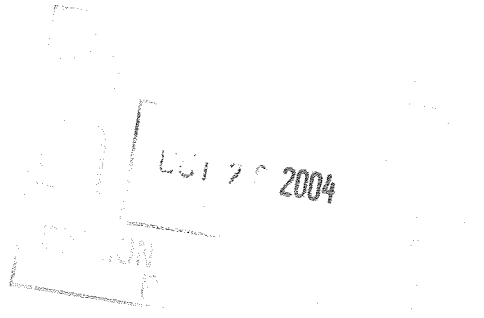
Very Truly Yours,

URS Corporation



Michael Gutmann
Technical Manager

cc: John Ruspantini, NYSEG
Mr. James Burke, NYSDEC-Syracuse
Ms. Wendy Kuehner, NYSDOH-Troy
File: 11173291.00000/C-1





New York State Electric & Gas Corporation
Former Clark Street Manufactured Gas Plant
Auburn, New York

**SUPPLEMENTAL REMEDIAL
INVESTIGATION WORKPLAN**
OCTOBER 2004

OCT 28 2004



Prepared For:
New York State Electric & Gas Corporation
Kirkwood Industrial Park
Binghamton, New York

URS

URS Corporation - New York

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1.0 INTRODUCTION

On behalf of NYSEG (New York State Electric & Gas Corporation), URS Corporation-New York (URS) is pleased to present the New York State Department of Environmental Conservation (NYSDEC) with this *Supplemental Remedial Investigation (SRI) Work Plan (SRI Work Plan)* for NYSEG's Clark Street Former Manufactured Gas Plant (MGP) site in Auburn, Cayuga County, New York. The location of the former MGP facility is shown in Figure 1. The NYSDEC's identification number for the site is 7-06-008.

This *SRI Work Plan* is being submitted to the NYSDEC as required under the Order on Consent (#DO-0002-9309) between NYSEG and the NYSDEC, dated March 25, 1994. The supporting documents (*Quality Assurance Project Plan (QAPP)*, *Field Sampling Plan (FSP)*, and *Health and Safety Plan (HSP)*) are appended to this *SRI Work Plan*. The *QAPP* and *HSP* are in Appendices A and B, respectively. The *FSP* is included with this document in Appendix C. Geologic cross-sections of the site developed as part of previous investigations are included as Appendix D.

The technical approach and scope is based on the investigative results collected by Atlantic Environmental Services, Inc. (AES) and Blasland, Bouck & Lee, Inc. (BBL). These previous investigations are summarized in these two documents:

- *Manufactured Gas Plant Site Screening Report, Clark Street Site, Auburn, New York*, prepared by Atlantic Environmental Services, Inc. (AES), May 1991.
- *Task II Remedial Investigation (RI) Report Former Manufactured Gas Plant Site, Clark Street, Auburn, New York*, prepared by Blasland, Bouck & Lee, Inc. (BBL), April 1994.

1.1 PROJECT OVERVIEW

From approximately 1901 through 1946, NYSEG (or its predecessor companies) used the former MGP site in Auburn to manufacture gas from coal. The site layout is shown in Figure 2.

Previous investigations of the site include an investigation conducted by AES in 1991, and a remedial investigation conducted by BBL in 1994. On March 25, 1994, NYSEG entered into an Order on Consent (Order) Index Number DO-0002-9309 with the NYSDEC to investigate and remediate 33 of NYSEG's former MGP sites. The Auburn site is covered by this Order.

Based on the background information available for the site and communications with NYSEG, URS has developed a scope of work to further characterize the site such that the nature and extent of MGP-related residuals are delineated in sufficient detail to evaluate remedial alternatives.

1.2 SRI WORK PLAN OBJECTIVES

The objectives of this *SRI Work Plan* are to:

- Review and compile contaminant distribution and other relevant background data from the historic documents for the site;
- Refine the site geological model;
- Delineate the horizontal and vertical extent of MGP-related contaminants in the site soils;
- Refine the site hydrologic model;
- Further evaluate the groundwater quality in the overburden groundwater regime;
- Characterize the groundwater quality in the shallow bedrock groundwater regime;
- Assess the vertical hydraulic gradients to determine the potential impacts to the Owasco Outlet;
- Delineate the horizontal and vertical extent of the groundwater contaminant plume in the overburden and shallow bedrock groundwater regimes;
- Delineate the horizontal and vertical extent of NAPLs in the overburden soil and groundwater (if present);
- Evaluate the potential impacts of site contaminants to surface water and sediments in the Owasco Outlet;
- Complete through Step IIB of a Fish and Wildlife Impact Analysis;

- Identify potential non-site related contaminant contributions to the Owasco Outlet sediments; and
- Identify potential pathways for human exposures as part of a qualitative exposure assessment.

The objectives for the SRI based on the review of this data are in Section 3.1.

1.3 ORGANIZATION OF THE SRI WORK PLAN

The *SRI Work Plan* contains six sections. Section 2.0 presents URS' understanding of the currently available site background information and Section 3.0 outlines our technical approach. URS' proposed scope of work is in Section 4.0. Section 5.0 outlines the tentative schedule for the proposed scope of work. Section 6.0 provides the references that URS used to prepare this document.

2.0 BACKGROUND

This section presents URS' understanding of the project, based on the available information provided by NYSEG and our review of publicly available documents.

2.1 SITE DESCRIPTION

The site is in Auburn, Cayuga County, in the Finger Lakes Region of New York State. The location of the site is shown on Figure 1. The site is approximately three acres in size and is currently occupied by a NYSEG substation transformer area and a gas regulation building. The substation transformer area is surrounded by a fence. The majority of the site is covered with gravel, with surrounding areas covered by trees and grassy areas. Land in the vicinity of the site is mixed commercial and residential. The site is bordered by a vehicle maintenance shop to the southwest, an access road and CSX right-of-way to the south, and the Owasco Outlet to the north and east. The locations of the present and former structures are shown on Figure 2.

2.2 SITE HISTORY

MGP operations at the Clark Street site began in approximately 1901. The gas house was at the southern edge of the property and consisted of an engine room, purifier room, meter room, generator room, and boiler room containing two boilers for steam production. Two gas holders were present north of the gas house, GH#2 (204,000 cubic feet) and GH#3 (75,000 cubic feet). An oil tank was west of the gas house, and a shed was north of the gas holders.

Citizen's Light, Heat & Power Company owned the site from 1901 to 1905. Auburn Gas Company owned the site from 1905 to 1911, and Empire Gas & Electric Company owned the site from 1911 to 1936. According to a 1926 Sanborn map included in BBL's 1994 *Task II RI Report*, GH#2 and GH#3 were still present, and a third gas holder, GH#1 (491,000 cubic feet) replaced the oil tank west of the gas house. The 1926 Sanborn map also showed that there was an unnamed tank between the gas house and GH#3. A third boiler was added to the gas house in 1943, and a coal storage area and a tar shed (later referred to as a tar pumping house) were added

on the north side of the gas house. NYSEG obtained ownership of the site in 1936. GH#2, GH#3 and the tank between the gas house and GH#3 were removed in 1939. Gas production continued until 1946, when portions of the gas house were converted to a carpenter shop, storage area, regulator room, fireproof regulator room, and booster room. By 1958, GH#1 was removed, the substation transformer area was built, the boiler room of the gas house was being used as a welding room, and a new boiler room was built on the north side of the building. The gas house was demolished in 1961, with the exception of the gas regulator building.

Historical plant operations were described in BBL's 1994 *Task II RI Report*. Coal was transported to the site via the railroad adjacent the site to the south. Coke ovens were used to generate coke from the coal. The byproduct gases may have been collected and reused as a fuel source for heating the coke ovens. The coke/coal was heated in the generator room and used as a fuel source for the boilers, which in turn produced steam. The steam was then introduced into the boilers to create blue gas. The blue gas was introduced into the carburetor/superheater (in the generator room) and sprayed with oil. Thermal cracking of the oil into gas produced gaseous hydrocarbons and tars. The carburetted water gas was then metered in the meter room and stored in the gas holders. The manufactured gas may have been stored in one of the gas holders (a relief holder) prior to purification to equalize pressure during the gas production process. GH#2 and GH#3 were water seal holders, which may have stored tars/water emulsions. GH#1 could have been a waterless holder. Prior to distribution, gases stored in these holders were metered through the meter room.

Most of the surrounding properties were historically occupied by a power company, a coal company, and manufacturing facilities. According to BBL's 1994 *Task II RI Report*, in the early 1900s the site was bordered to the southwest by the Auburn and Syracuse Electric Company Power House, later designated as the Niagara, Lockport, & Ontario Power Company. By 1939, the power company was no longer present and Blue Moon Coal Company occupied at least a portion of the former power company property. Lehigh Valley Railroad Yards (formerly the Southern Central Valley Railroad) was further south of the site. A 1939 Sanborn map indicated that a filling station and the American Locomotive Company were also southwest of the site.

Manufacturing facilities that included a shoe factory, paper box factory, and clothing company were in operation east of the site.

The site is currently occupied by a NYSEG substation transformer area and a gas regulator building. The foundation of the former gas house and former GH#1 are partly visible, as well as portions of the former coke ovens southwest of the gas house.

2.3 PHYSICAL SETTING

The site is generally flat lying, at an average elevation of approximately 634 feet above mean sea level (msl). The ground slopes gently toward the Owasco Outlet to the north and east. The sediments in the outlet are cobbles and rocks with coarse sand and gravel and some organic material. The southwest portion of the site borders a ridge. Surface water runoff at the site flows to the Owasco Outlet, which flows from east to west. Ponding of rainwater occurs onsite, but infiltration is generally restricted by the relatively impermeable surface soil and fill.

2.3.1 Geology

The site is located in the Ontario Lowland physiographic province, which is generally characterized as a poorly drained and fairly level plain. The area was glaciated, and overburden consists of gravel, sand, silt, and clay.

Appendix D presents three cross-sections from BBL's 1994 *RI Report*. The cross-sections show the general composition of overburden materials beneath the site. Fill material beneath the site consists of sand, gravel, and silt with brick fragments, concrete fragments, wood, and slag. The bedrock underlying the site is the Onondaga Limestone, which consists of Devonian age limestones and shales. Previous investigations revealed mostly shale with minor occurrences of limestone. Depth to the top of bedrock ranges from 12 to 15 feet below ground surface (bgs).

2.3.2 Hydrogeology

There are no major aquifer systems in the Auburn area. According to AES' 1991 report, there is a city ordinance in Auburn, which forbids homeowners to drill wells on their properties. There are no pumping wells on or adjacent to the site, and the closest well is approximately 1 3/4 miles west of the site. According to previous investigations and as shown by the cross-sections in Appendix D, depth to water at the site is approximately 4 feet bgs.

In 1994, BBL conducted a hydrogeologic characterization of the site. BBL determined that the bedrock acts as a confining unit, but did not determine the degree of connectivity between the overburden and bedrock groundwater regimes. A semi-confining silt layer is also present above the bedrock in portions of the site. Groundwater flow at the site is generally to the north and east.

2.4 PREVIOUS INVESTIGATIONS

This section briefly summarizes the two previous investigations completed at the site: an investigation conducted by AES in 1991, and a remedial investigation conducted by BBL in 1994. The scope of work completed during these two investigations is described below, followed by a summary of the findings of the previous activities. Groundwater analytical results from an October 31, 1996 sampling event are also provided. Figures 3 through 6 and Tables 1 through 5 summarize the available analytical results from these previous investigations.

2.4.1 *Manufactured Gas Plant Site Screening Report, Clark Street Site, Auburn, New York, prepared by Atlantic Environmental Services, Inc., May 1991.*

In 1991, AES conducted an investigation to prioritize a number of MGP sites for NYSEG to determine if there was any threat to human health or the environment and establish a relative ranking of NYSEG's MGP sites.

Three surface water and three sediment samples were collected from the Owasco Outlet from locations upstream of (CGAC-SW1/CGAC-SE1), adjacent to (CGAC-SW2/CGAC-SE2) and

downstream of (CGAC-SW3/CGAC-SE3) the site. The surface water and sediment sample locations are shown on Figure 2. The surface water samples were analyzed for volatile organic compounds (VOCs) (EPA Method 624), semivolatile organic compounds (SVOCs) (EPA Method 625), metals (EPA Method 200.7), lead (EPA Method 7191), chromium (EPA Method 7421), and cyanide (EPA Method 335). The surface water analytical data is summarized in Table 4. The sediment samples were analyzed for VOCs (EPA Method 8240), SVOCs (EPA Method 8270), metals (EPA Method 6010), lead (EPA Method 7191), chromium (EPA Method 7421), and cyanide (EPA Method 9010). The sediment analytical data is summarized in Table 5.

Five surface soil samples were collected from a depth of 0-6 inches from five randomly selected points onsite (CGAC-SS1 through CGAC-SS5). The surface soil samples were analyzed for the same parameters as the sediment samples. The locations of the five surface soil samples are shown on Figure 2 and the surface soil analytical data is summarized in Table 2.

2.4.2 Task II Remedial Investigation Report Former Manufactured Gas Plant Site, Clark Street, Auburn, New York, prepared by Blasland, Bouck & Lee, Inc., April 1994.

In 1994, BBL conducted a Remedial Investigation with the following objectives:

- Identify and delineate the potential contaminant source areas, including characterization of residues present;
- Define the extent of contaminants in various environmental media (soils, groundwater, and sediments); and
- Determine if the residues and associated contaminants present a significant threat to human health and/or the environment.

BBL's scope of field work is described in the following tasks and subtasks:

- Source Investigation
 - Excavation of Test Pits
 - Installation of Test Borings

- Characterization of Underground Tanks
- Surface Soil Investigation
- Groundwater Investigation
 - Monitoring Well Installation
 - Groundwater Sampling and Analysis
- Sediment Investigation
 - Sediment Probing
 - Sediment Sampling and Analysis

Source Investigation

During this investigation, nine test pits (TP-01 through TP-09) were excavated within the vicinity of the potential source areas (three former gas holders, former tar pump, and former oil tank) to a depth of 3 to 6.5 feet bgs. Five soil samples containing coal tar residues were obtained from the test pits (TP-01, TP-02, TP-04, TP-05, and TP-09) at a depth of 2 to 4 feet (interval exhibiting visual indications of coal tar residues) and analyzed for VOCs (EPA Method 8240), SVOCs (EPA Method 8270), metals (EPA Methods 6010/7000), and cyanide (EPA Method 9010). In addition, two soil samples (TP-01 and TP-02) were analyzed for waste disposal characterization for BTU content (EPA Method A006) and reactivity (cyanide, sulfide) (EPA Chapter 7.3 methods in *Test Methods for Evaluating Solid Waste*, 1990).

Within the vicinity of the potential source areas (three former gas holders, former tar pump, and former oil tank) and in areas where test pit excavations could not be performed, 17 test borings (TB-01 through TB-17) were advanced through the overburden to the top of bedrock to a depth of 11.8 to 14.7 feet bgs. One rock core (RH-1) was advanced through the overburden and the upper 15 feet of bedrock to a depth of 30 feet bgs. Seven soil samples containing coal tar residues from five test boring locations (TB-03, TB-06, TB-10, TB-12, and TB-15) were submitted for the same analyses as the test pit soil samples. The samples were selected from intervals exhibiting visual indications of coal tar residues that were not previously obtained during the test pit excavations. In addition, two samples (TB-09 and TB-14) were analyzed for grain size using ASTM procedure D-422, and three samples (TB-06, TB-10, and TB-15) were analyzed for waste disposal characterization for BTU content (EPA Method A006) and reactivity

(cyanide, sulfide) (EPA Chapter 7.3 methods in *Test Methods for Evaluating Solid Waste*, 1990), and a gas chromatograph (GC) - flame ionization detector (FID) fingerprint.

Excavations to characterize two vessels southwest of GH#1 revealed that the vessels are approximately three feet in diameter by eight feet deep. These two vessels are shown on Figure 2. Water was present at a depth of three feet below the top of the vessels, and a coal tar odor was observed when the top of each vessel was removed. According to a former MGP employee, the vessels were gate valves used to regulate pressure in the gas holders. A composite sample of the water in the vessels was analyzed for VOCs (EPA Method 8240), SVOCs (EPA Method 8270), metals (EPA Methods 6010/7000), and TOC (Lloyd-Kahn). It is unclear whether the vessels were removed during BBL's 1994 RI.

Surface Soil Investigation

Five surface soil samples (SF-01 through SF-05) were collected from the ground surface to a maximum depth of 0.5 feet bgs and analyzed for VOCs (EPA Method 8240), SVOCs (EPA Method 8270), metals (EPA Methods 6010/7000), total and amenable cyanide (EPA Method 9010), and PCBs (EPA Method 8080). Four of the samples were collected from locations at which MGP-related residues were observed in the test pits and test borings during the source investigation and one background sample was collected. The surface soil sample locations are shown on Figure 2.

Groundwater Investigation

As summarized in Table 6 and shown on Figure 2, five overburden monitoring wells were installed to depths of 12 to 15 feet bgs. Monitoring wells MW-01 and MW-02 were installed hydraulically upgradient of the former MGP structures, and monitoring wells MW-03, MW-04, and MW-05 were installed hydraulically downgradient of the former MGP structures. Three soil samples from four to six feet bgs from monitoring well locations MW-01, MW-02, and MW-05 were selected for grain-size analysis using ASTM procedure D-422. In-situ hydraulic conductivity tests were performed at each of the five wells. Additionally, four stream gauges were installed within and adjacent to the Owasco Outlet.

As summarized in Table 1, the five monitoring wells were sampled on a quarterly basis starting in December 1992 and continuing through September 1993. As part of the quarterly sampling program, groundwater and surface water levels were collected from the monitoring wells and staff gauges, respectively. The groundwater samples from the December 1992 sampling round were analyzed for VOCs (EPA Method 8240), SVOCs (EPA Method 8270), metals (EPA Methods 6010/7000), total and amenable cyanide (EPA Method 9010), and PCBs (EPA Method 8080). Groundwater samples from the next three quarters were analyzed for VOCs (EPA Method 8020), SVOCs (EPA Method 8270), metals (EPA Methods 6010/7000), total and amenable cyanide (EPA Method 9010).

Sediment Investigation

Twenty-five sediment probes were completed along the bank of the Owasco Outlet at intervals of approximately 25 feet and a depth of penetration of generally less than one foot. Nine sediment samples (SS-01 through SS-09) were obtained from the Owasco Outlet and analyzed for VOCs (EPA Method 8240), SVOCs (EPA Method 8270), metals (EPA Methods 6010/7000), total and amenable cyanide (EPA Method 9010), TOC (Lloyd-Kahn), and percent solids in soil for moisture content (ASP 91).

2.4.3 Summary of Analytical Data

A summary of the analytical data generated during the two previous investigations and the October 31, 1996 groundwater sampling event has been presented on Figures 3 through 6 and on Tables 1 through 5. The groundwater data presented on Figure 3 shows the most recent analytical data from October 31, 1996 and has been summarized for the purposes of this discussion.

Groundwater

The groundwater analytical results from the October 31, 1996 sampling event are summarized in Table 1 and Figure 3. BTEX (benzene, toluene, ethylbenzene, and xylenes) was detected in concentrations exceeding the NYSDEC groundwater quality standards in groundwater samples from monitoring wells MW-04 and MW-05. The highest concentration of BTEX was detected

in groundwater sample from monitoring well MW-05 (6,4610 µg/L). Several SVOCs, mostly polycyclic aromatic hydrocarbons (PAHs), were detected in groundwater samples from monitoring wells MW-04 and MW-05, with the highest concentration detected in MW-05 (1,701 µg/L). Cyanide was detected in groundwater samples from monitoring wells MW-02 through MW-05. Several metals (arsenic, antimony, chromium, lead, and selenium) were also detected in the groundwater samples at concentrations exceeding the NYSDEC groundwater quality standards.

Surface Soil

The surface soil analytical results for the ten surface soil samples collected in 1991 and 1994 are summarized in Table 2 and Figure 4. VOCs were not detected above NYSDEC Recommended Soil Cleanup Objectives (RSCOs) in any of the ten surface soil samples. Several SVOCs, mostly PAHs and carcinogenic PAHs (cPAHs), were detected above the NYSDEC RSCOs in all surface soil samples. Cyanide was detected in soil samples CGAC-SS2 and CGAC-SS3 downgradient of the gas holders. Several metals (cadmium, chromium, copper, iron, nickel, and zinc) were also detected in concentrations exceeding NYSDEC RSCOs in soil samples.

Subsurface Soil

The subsurface soil analytical results are summarized in Table 3 and Figure 5. Several VOCs (BTEX, acetone, methylene chloride, and tetrachloroethene) and SVOCs (including PAHs and cPAHs) were detected in subsurface soil samples across the site at concentrations exceeding the NYSDEC RSCOs. The highest concentrations were detected in the vicinity of the former gas holders. Cyanide was detected in ten of the 17 historical subsurface soil samples. Several metals (arsenic, cadmium, chromium, copper, iron, nickel, selenium, and zinc) were detected in subsurface soils at concentrations exceeding the NYSDEC RSCOs.

Surface Water

The results of the surface water analyses are summarized in Table 4. Only zinc was detected in two of the three surface water samples taken in 1990. Both samples CGAC-SW1, upstream of the site, and CGAC-SW3, downstream of the site, had concentrations of 94 µg/L.

Sediment

The results of the sediment analytical results are summarized in Table 5 and Figure 6. VOCs (mostly BTEX) and SVOCs (including PAHs and cPAHs) were detected in sediment samples from the Owasco Outlet along the entire perimeter of the site. Cyanide was detected at one location adjacent to the site (CGAC-SE2) and two downstream locations (SS-07 and SS-09). Several metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc) were also detected in the sediment samples.

NAPL

As shown on the cross-sections in Appendix D and listed below, BBL observed variable types of non-aqueous phase liquid (NAPL) residues in the overburden on the site:

- Black stained soil mixed with fill debris;
- Amber oil globules;
- Coal tar residue mixed with soil;
- Thick black coal tar; and
- Black solid, brittle residue mixed with slag.

2.5 CONCEPTUAL SITE MODEL

Based on the historical information gathered through the previous investigations, URS developed a conceptual site model. As shown on Figure 7, the horizontal extent of the contamination in the overburden is generally limited to the MGP-related structures themselves. NAPL is likely pooled on the bedrock surface and above the semi-confining silt layer, and may enter the bedrock through fractures. NAPL may be transported along the top of bedrock and through bedrock fractures to the Owasco Outlet and beyond.

3.0 TECHNICAL APPROACH

This section summarizes the objectives of the supplemental remedial investigation and our technical approach to meet these objectives.

3.1 OBJECTIVES

The specific objectives for the SRI are to:

- Review and compile contaminant distribution and other relevant background data from the historic documents for the site;
- Refine the site geological model;
- Delineate the horizontal and vertical extent of MGP-related contaminants in the site soils;
- Refine the site hydrologic model;
- Re-characterize the groundwater quality in the overburden groundwater regime;
- Characterize the groundwater quality in the shallow bedrock groundwater regime;
- Assess the vertical hydraulic gradients to determine the potential impacts to the Owasco Outlet;
- Delineate the horizontal and vertical extent of the groundwater contaminant plume in the overburden and shallow bedrock groundwater regimes;
- Delineate the horizontal and vertical extent of NAPLs in the overburden soil and groundwater (if present);
- Evaluate the potential impacts of site contaminants to surface water and sediments in the Owasco Outlet;
- Complete through Step IIB of a Fish and Wildlife Impact Analysis;
- Identify potential non-site related contaminant contributions to the Owasco Outlet sediments upstream of the site; and
- Identify potential pathways for human exposures as part of a qualitative exposure assessment.

Our investigation is focused on collecting the data that is needed to address these objectives.

3.2 PROJECT STRATEGY

Our overall strategy is to focus on defining the extent of MGP-related wastes in the soil and groundwater in and around the site. Thus, a scope of work has been developed to maximize the amount of data collected during the SRI, while limiting the number of data gaps requiring additional investigation activities. The results of this investigation will be used to further characterize the site to effectively evaluate remedial alternatives.

3.2.1 Investigation

Based on the nature of coal tar constituents, the possible modes of release, and the local geology, the extent of the MGP-related constituents may be limited to the former MGP structures themselves. Soil and groundwater samples will be collected from strategic locations near and within the former structures to evaluate whether, and to what extent, releases from historic MGP operations may have occurred, and whether these releases have impacted the shallow bedrock groundwater regime, and the Owasco Lake Outlet (surface water and sediments). A detailed characterization of the Owasco Lake Outlet will be a primary component of the investigation. The characterization will include detailed stream profiles, probing of sediment thickness, and textural characterization of the sediments. URS will also conduct a reconnaissance of the watercourse from the site to approximately ½ mile upstream of the site to identify any other potential point sources of contamination.

Figure 2 shows both current and historical site features. The scope of work associated with each of the investigation areas is presented in Section 4.0 and summarized in Table 7.

3.2.2 Analytical Program

Table 8 summarizes the laboratory analytical program for this investigation. Samples collected during this phase of the SRI will be analyzed by Ecology & Environment, Inc. in Lancaster, New York, a New York State ASP Laboratory. Ecology & Environment will provide ASP Category B Quality Assurance/Quality Control (QA/QC) deliverables package for analytical data. Selected

soil and sediment samples will be analyzed by META Environmental Services, Inc. of Watertown, Massachusetts, a specialty laboratory with expertise in forensic analysis. META evaluates the patterns and ratios of PAHs and will attempt to determine if the PAHs are attributable to MGP processes.

The analytical program has been developed based on the background data provided by NYSEG and our general knowledge of wastes and chemicals of interest at other MGP sites (ERT and Koppers Company, 1984; GRI, 1987). The compounds previously detected at this site include VOCs (primarily BTEX), SVOCs (primarily PAHs, including cPAHs), cyanides, and metals.

Soil and sediment samples collected for analysis during the SRI will be analyzed for BTEX, target compound list (TCL) SVOCs, SVOCs (expanded PAHs), TCL polychlorinated biphenyls (PCBs), total phenols, target analyte list (TAL) metals (Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, Zn), cyanides (total, free, and by speciation), and total organic carbon (TOC). In addition, soil samples will also be analyzed for natural oxidant demand (NOD). Three soil samples will be analyzed for reactivity, total sulfur, and toxicity characteristic leaching procedure (TCLP) benzene to determine the waste profile for disposal of investigative-derived waste.

Surface water and groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, SVOCs (expanded PAHs), TCL PCBs, total phenols, TAL metals, and cyanides. Groundwater samples will also be analyzed for alkalinity, chloride, nitrate/nitrite, sulfate/sulfide, dissolved iron, ferrous iron, and total dissolved solids. These parameters will be utilized to evaluate geochemical conditions in the subsurface that can affect or indicate the degree of natural attenuation processes occurring at the site. During the SRI, two rounds of groundwater sampling will be completed. All newly installed monitoring wells and the existing wells will be sampled during both events.

Although metals are often present at former MGP sites, they typically do not contribute significantly to the risks. Cyanides are typically found at former MGP sites. However, they are typically not highly toxic free cyanide (as HCN) or cyanide salts (e.g., CdCN, ZnCN), but rather are stable cyanide-iron complexes that have little toxicity (ERT and Koppers Company, 1984).

A significant potential source of cyanide exists in the form of spent oxide chips. The form of the cyanide present at the Auburn site is unclear and will be evaluated during the completion of the SRI. The soil will be analyzed for total cyanide, free cyanide (micro-diffusion technique), and cyanide by speciation (ion chromatography technique). This will provide useful information regarding the type of cyanide that exists in the soils. If the type of cyanide present in the soil consists mainly of stable metallo-cyanide complexes and not free cyanide, then impact to the environment is minimal.

In addition, selected groundwater samples will be analyzed for, alkalinity, dissolved total organic carbon, nitrate/nitrite, sulfate/sulfide, ferrous iron, and dissolved iron. These parameters will be utilized to evaluate geochemical conditions in the subsurface that can affect or indicate the degree of natural attenuation processes occurring at the site. In select instances, both soil and groundwater samples will be analyzed for full VOC and SVOC parameters. The samples selected for these analyses will be based on past practices (such as the area near the former gas house). As for cyanide analysis, historical data indicates that cyanide is not a significant problem in the groundwater. Therefore, the groundwater samples will be analyzed for total cyanide only. If total cyanide (as total) is not detected in the groundwater samples, then no further analysis will be conducted. However, if total cyanide is detected in the groundwater samples, then free cyanide and cyanide by speciation analyses will be performed on the samples.

Natural attenuation parameters will be measured both within and outside suspected plume areas in order to define differences in the parameter values between zones of active degradation and zones of no contamination/activity. Measurement of these parameters is required in order to demonstrate that monitored natural attenuation is a viable remedial approach at this site.

Many of the compounds in coal tar and other organic byproducts from manufactured gas production are biodegradable. These hydrocarbons are oxidized to carbon dioxide. The following parameters will be measured to provide indications regarding whether naturally occurring biodegradation is occurring in the groundwater:

<u>Parameter</u>	<u>Reason</u>
Oxygen	Aerobic degradation removes oxygen, reducing this parameter
Ferrous iron	Anaerobic reduction of ferric iron creates ferrous iron
Nitrate	Nitrate is reduced to NO_2^- , N_2O , NO , NH_4^+ , or N_2 reducing this parameter
Sulfate	Sulfate is reduced to H_2S , reducing this parameter

Of these parameters, all but ferrous iron are the ultimate electron acceptors of various biological metabolic mechanisms used to oxidize the MGP hydrocarbon contaminants.

In contrast to hydrocarbon attenuation, chlorinated organics are degraded through reductive dechlorination. The following parameters will be measured to follow anaerobic reductive dechlorination of chlorinated organics:

<u>Parameter</u>	<u>Reason</u>
Total Organic Carbon	Organic carbon acts as an electron donor to allow reduction to occur
Chloride	Reductive dechlorination releases chloride to the aquifer
Oxygen	Reductive dechlorination is exclusively an anaerobic procedure
Redox Potential	This parameter measures the degree of reducing power within the aquifer.
Ferrous iron	Under the reducing conditions needed, ferric iron is reduced to ferrous iron
Sulfate, Nitrate	Sulfate and nitrate are electron acceptors used under anaerobic conditions. A localized depletion of these anions compared to background suggests the occurrence of active anaerobic metabolism.
Sulfide	Sulfide, like ferrous iron, suggests conditions of strong enough reducing power that may be sufficient to promote reductive dechlorination.

Portions of the Auburn site may be candidates for in-situ remediation using techniques such as chemical oxidation, solvent flushing, or heating. To effectively implement these technologies, URS will thoroughly describe the site lithology and contaminant distribution, including NAPL distribution. In addition to the conventional site characterization sampling and analyses, additional parameters need to be measured to assist in the evaluation of in-situ treatment

technologies. Of the three in-situ remediation technologies, only chemical oxidation is a destructive technology whose effectiveness relies on the chemical properties of the aquifer. To better evaluate the predicted effectiveness of this technology, URS proposes that the following parameters be analyzed:

<u>Parameter</u>	<u>Reason</u>
NOD	The natural oxidant demand (NOD) measures the amount of naturally occurring organic and inorganic material that would compete with the contamination for the oxidation reagents. This parameter should be measured in samples taken from uncontaminated areas (but with soil and groundwater otherwise similar to the contaminated areas) in order to estimate only the naturally occurring constituents contributing to oxygen demand.
Alkalinity	Certain oxidation reagents require low pH environments to be effective. This parameter helps evaluate how feasible it would be to adjust the pH to appropriate levels.
Total Dissolved Solids	High ionic strength can reduce oxidation reaction rates. This parameter is also useful for evaluating in situ heating through electrical conduction.

4.0 PROPOSED SRI SCOPE OF WORK

The scope of work consists of the following seven tasks:

Task 1 – Soil Borings and Soil Sampling

Task 2 – Monitoring Well Installation

Task 3 – Groundwater Sampling

Task 4 – Test Trenches

Task 5 – Surface Water and Sediment Sampling

Task 6 – Step IIB Fish and Wildlife Impact Analysis

Task 7 – Qualitative Risk Assessment

Task 8 – Analyze Data and Prepare Report

The remainder of this section describes these seven tasks and their associated subtasks.

NAPL may be encountered during various phases of this SRI, specifically during drilling of soil borings, well installations, and test trench excavations. The specific response or alteration to the task will be contingent upon several factors, including, but not limited to, the depth at which NAPL is encountered, the location of the NAPL relative to building structures or confining units, the amount or nature of NAPL encountered, and the goal of the task. Potential response scenarios may include installing a well that screens the impacted area (i.e., NAPL well), casing off the impacted zone and resuming the boring or well installation below the impacted area, abandoning and relocating the boring or well, or proceeding as normal with the task. Overburden monitoring wells that are to be NAPL recovery wells will be completed with a two-foot long riser with a bottom cap (installed into rock) below the PVC well screen to serve as a sump for NAPL recovery. The sump will be sealed to the borehole by bentonite, to prevent any NAPL accumulation outside of the sump. If it is determined that a monitoring well is needed below an identified zone of NAPL or MGP residuals in soil, the potential for downward NAPL migration will be mitigated by casing the off the impacted zone by grouting a six-inch diameter steel casing to the borehole and completing the well with two-inch PVC well materials with a two-foot long sump thereby installing a double-cased well. The response will be coordinated

with URS, NYSEG, and the NYSDEC in a way that meets the overall objectives of this SRI, which is to define the nature and extent of contamination at the site. During the implementation of the SRI scope of work, URS personnel will conduct community air monitoring in accordance with the NYSDOH guidance. The community air monitoring plan for this project is provided as an addendum to the *Health and Safety Plan* (Appendix B).

4.1 TASK 1 – SOIL BORINGS AND SOIL SAMPLING

The focus of this task will be to delineate horizontal and vertical extent of MGP-related contaminants in the subsurface. URS will advance soil borings for the purposes of visually screening the subsurface materials, and collect selected soil samples for chemical characterization. Three surface soil samples will also be collected for laboratory analysis as part of this task.

A total of 21 soil borings (GB-1 through GB-21) will be advanced in five areas using a Geoprobe™ or equivalent direct push equipped rig. As shown on Figure 8 and described in Table 7, soil borings GB-1 through GB-3 will be advanced near former gas holder #1, borings GB-4 through GB-6 will be advanced near former gas holder #3, borings GB-7 through GB-9 will be advanced near the former tar pump and oil tank, borings GB-10 through GB-12 will be advanced near former gas holder #2, and borings GB-13 through GB-15 will be advanced near the former gas house and purifying room. As shown on Figure 8, the former coke ovens and two former coal sheds were present west of the site. Boring GB-16 will be advanced near the former coke ovens, and boring GB-17 will be advanced near the former coal shed that was north of the vehicle maintenance shop on the property west of the site. Boring GB-18 will be advanced near the former coal shed that was approximately 50 west of former GH#3. Boring GB-19 will be advanced in the area northeast of GH#1. Boring GB-20 will be advanced near the central portion of former GH#2 and near the southwest corner of the substation. Boring GB-21 will be advanced near the central portion of the substation transformer area. If the central portion of the substation proves to be inaccessible for drilling, then the boring will be re-located outside the substation footprint, northeast of boring GB-11, along the southeast fence line of the substation.

Each of the proposed soil borings will be advanced to the bedrock surface at a depth of approximately 12 to 15 feet below ground surface (bgs).

The 21 soil borings will be advanced using a Geoprobe rig. Soil samples will be collected using four-foot long MacroCore samplers. Discrete samplers will be used to advance the borings below four feet bgs to the bottom of the boring (top of bedrock). Once at the appropriate depth, each sample tube will be retrieved from the subsurface and the sample tube cut along its length and screened, visually and with a photoionization detector (PID), for the presence of contamination, and placed in sample jars for potential analysis.

Based on the field screening results (visual and PID readings), up to seven borings, which exhibit minimal MGP residues in the soil or do not indicate the presence of MGP impacts will be identified. One soil sample will be submitted for laboratory analysis from each of these seven borings. This sample will be collected from the two-foot interval exhibiting the highest level of potential impacts based on field screening. If no contamination is evident, the sample will be collected from the two-foot interval corresponding to the water table interface.

Two soil samples will be submitted for laboratory analysis from the remaining 14 borings. For these 14 borings, one soil sample will be collected from the two-foot interval exhibiting the highest level of contamination based on field screening or from the water table interface if no contamination is evident. The second soil sample will be collected from the two-foot interval directly below the area exhibiting elevated levels of contamination. If no contamination is evident, the second soil sample will be collected from the bottom of the boring.

Following completion of each soil boring, the boring will be backfilled to the surface with cement-bentonite grout or bentonite pellets. All soil generated during the advancement of the borings will be containerized and stage onsite at a location designated by NYSEG for later disposal. The soil sampling procedures are more fully described in the *FSP* and *QAPP*.

As shown in Table 8, the 35 soil samples will be analyzed for BTEX (USEPA Method 8260B), TCL SVOCs (USEPA Method 8270C), TCL PCBs (USEPA Method 8082), total phenols

(USEPA Method 9065), TAL metals (USEPA Methods 6010B/7471A/7470A), and total cyanide (SW9012A). Selected soil samples will be analyzed for free cyanide (ASTM 4282-02), cyanide by speciation (Wallschlager, D) ferrous and ferric cyanides, TOC (Lloyd Kahn), and NOD. One soil sample will be analyzed for reactivity, total sulfur, and TCLP benzene (USEPA Method 1311/8260B). The analytical data generated from Geoprobe soil sampling will be reported by the laboratory with ASP Category B QA/QC deliverables.

In addition, up to three soil samples, which exhibit NAPL or MGP residuals will also be submitted to Meta Environmental Services, Inc. of Watertown, Massachusetts for further analyses. These three soil samples were analyzed for hydrocarbon fingerprints by EPA Method 8100 and extended PAH profiles by modified EPA Method 8270 to evaluate whether some of the PAHs in the soil originated from sources other than the former MGP site.

Three surface soil samples will be collected from the property south of NYSEG's property. The proposed surface soil sampling locations are shown on Figure 8. The final locations for these surface soil samples will be agreed upon between NYSEG, URS, NYSDEC, and NYSDOH. The three surface soil samples will be grab samples collected from two-inches beneath the vegetative cover to a maximum depth of 1-foot bgs and analyzed for TCL SVOCs (USEPA Method 8270C), TAL metals (USEPA Methods 6010B/7471A/7470A), and total cyanide (SW9012A).

4.2 TASK 2 – MONITORING WELL INSTALLATION

In order to evaluate the vertical extent of groundwater contamination at the site and assess the hydraulic communication between the overburden and bedrock groundwater regimes, one overburden monitoring well MW-06 and six shallow bedrock monitoring wells (MW-01B, MW-02B, MW-03B, MW-04B, MW-05B, and MW-06B) will be installed. The locations of the five proposed bedrock monitoring wells (MW-01B, MW-02B, MW-03B, MW-04B, MW-05B, and MW-06B) are presented on Figure 8 and described in Table 7. The proposed monitoring wells will be paired with existing overburden monitoring wells. Proposed monitoring well MW-01B will be installed upgradient of the source areas. Proposed monitoring well MW-02B will be installed south of GH#1. Proposed monitoring well MW-03B will be installed downgradient of

GH#1, and proposed monitoring well MW-04B will be installed downgradient of GH#1, GH#2, and GH#3. Proposed monitoring well MW-05B will be installed east of GH#2. Proposed monitoring well pair MW-06 and MW-06B will be installed in the area north of GH#2 and GH#3.

The monitoring wells will be drilled by advancing a hollow-stem augers through the overburden until bedrock is encountered. Continuous split-spoon samples will be collected in the overburden, described by a field geologist, and field screened for the presence of NAPLs and VOCs.

For the installation of the overburden monitoring well, a string of two-inch, flush-threaded, new PVC well riser and screen will be installed through the HSAs. If the overburden monitoring well is to screen a NAPL impacted zone, the well will be completed with a two-foot long riser with a bottom cap (installed into rock) below the PVC well screen to serve as a sump for NAPL recovery. The sump will be sealed to the borehole by bentonite, to prevent any NAPL accumulation outside of the sump. A sand pack will be installed around well screen to a depth extending two to three feet above the top of the screen. During installation of the sand pack, the augers will be withdrawn in small increments so as to avoid disturbing the sand pack. A 24-inch thick (minimum) seal of bentonite pellets will be placed over the sand pack and hydrated. For shallow monitoring wells, where the top of the screen is above the water table, hydration of the bentonite clay pellets will be accomplished using distilled or potable water.

A bentonite-cement grout consisting of approximately seven pounds of powdered bentonite per 94-pound sack of Portland cement, and not more than six gallons of clean water per 94-pound sack of cement, will be introduced into the borehole annular space by injection under pressure using a tremie pipe. The grout must be allowed to set and cure for at least 48 hours before commencing well development or other activities, which might disturb the seal.

For the shallow bedrock monitoring wells, after the soil sampling is completed the HSAs will be removed from the ground leaving a pilot hole for the overburden casing. The driller will then drive a 6-inch inside diameter steel casing to the top of bedrock. A 5 7/8 inch diameter roller bit

will then be lowered into the 6-inch casing. Using wash rotary drilling methods, a 5-foot long rock socket will be drilled into the bedrock surface. A four-inch diameter steel casing will be set into the rock socket and the 6-inch casing will be removed. This four-inch diameter casing will be pressure grouted to the borehole with a cement-bentonite grout mixture.

After the grout has been allowed to cure for at least 24 hours, bedrock will be continuously cored using a NX (2.150-inch nominal diameter) core bit to the desired total depth, ten feet below the bottom of the rock socket. Based on the observations from the bedrock core, the well will either remain open hole, or the boring will be reamed out to allow for construction of a two-inch diameter monitoring well. If a monitoring well is installed, it will contain a two-foot sump constructed of a riser with a bottom cap. Furthermore, if well casing and screen are installed, the annulus between the well screen and the borehole will be filled with a sand pack. A minimum of a two-foot thick bentonite seal will be placed above the sand pack. The remaining portion of the annulus, above the bentonite seal, will be filled with cement grout.

Upon completion, all new wells will be developed using surging and pumping methods to remove fine-grained sediments from the sand pack and to improve the hydraulic communication between the well screen and the surrounding aquifer. Development will continue until water is visibly free of suspended sediments. Development water will be containerized in drums or a temporary storage tank for future off-site disposal.

One soil sample will be submitted for laboratory analysis from six of the seven well borings. These samples will be collected from the four-foot interval exhibiting the highest level of impacts based on of field screening. If no contamination is evident, the sample will be collected from the two-foot interval corresponding to the water table interface.

As shown in Table 8, the six soil samples will be analyzed for BTEX (USEPA Method 8260B), TCL SVOCs (USEPA Method 8270C), TCL PCBs (USEPA Method 8082), total phenols (USEPA Method 9065), TAL metals (USEPA Methods 6010B/7471A/7470A), total cyanide (SW9012A). Selected soil samples will be analyzed for extended PAHs (modified USEPA Method 8270C), free cyanide (ASTM 4282-02), cyanide by speciation (Wallschlager, D) ferrous

and ferric cyanides, TOC (Lloyd Kahn), and NOD. One soil sample will be analyzed for reactivity, total sulfur, and TCLP benzene (USEPA Method 1311/8260B). The analytical data generated from soil samples collected during installation of the monitoring wells will be reported by the laboratory with ASP Category B QA/QC deliverables.

After the newly installed wells are allowed to equilibrate for one to two weeks following development, the depth to water in each existing and newly installed well will be measured. Each well will also be monitored for the presence of NAPLs using an electronic interface probe and dedicated disposable weighted cords before purging and sampling (Section 4.3). Decontamination will not be required as the weighted cords will be dedicated to each well location with NAPLs, and potential for cross-contamination will be minimized. Note that purging and sampling will not be performed if NAPLs are encountered at any given location. If LNAPLs are encountered in recoverable amounts, URS may recommend bail-down testing to evaluate the thickness of LNAPLs (if any) in the subsurface. At locations where NAPL is encountered, a NAPL sample will be collected and analyzed for BTEX (USEPA Method 8260B), extended PAHs (modified USEPA Method 8270C), and total cyanide (SW 9012A). For the purposes of site characterization prescribed by this SRI, only one NAPL sample will be collected and analyzed from each well, where encountered.

Furthermore, at the well locations where NAPLs are encountered in recoverable amounts, NYSEG will initiate a periodic NAPL recovery program. We anticipate that, initially, NAPLs will be recovered on a weekly basis using disposable weighted bailers dedicated to each well location containing NAPLs. Based on the amounts of NAPLs recovered manually over an estimated period from one to three months, the frequency of manual NAPL recovery may be adjusted, or the installation of an automated recovery system may be considered.

In-situ hydraulic conductivity testing will be conducted at each newly installed shallow bedrock monitoring well and the new overburden monitoring well to estimate the horizontal hydraulic conductivity of the bedrock. Rising-head and falling-head tests will be performed in accordance with the procedures provided in Appendix C Field Sampling Plan.

4.3 TASK 3 – GROUNDWATER SAMPLING

During the SRI, two groundwater sampling events will be completed. At this time, it is anticipated that the first sampling event will be completed in the Fall of 2004 and the second sampling event will be completed in the Spring of 2005.

Prior to groundwater sampling, water level measurements will be taken at each new and existing monitoring well location. During the initial round of water level measurements, the total depth will be checked and the need for redevelopment will be evaluated. Monitoring wells will also be checked for visual or olfactory evidence of coal tar.

For the first sampling event, groundwater samples will be collected from overburden well MW-06, each of the shallow bedrock monitoring wells installed during the SRI (MW-01B, MW-02B, MW-03B, MW-04B, MW-05B, and MW-06B), along with the existing monitoring wells which were installed during previous investigations (MW-01 through MW-05), a minimum of two weeks following installation and development of the last SRI well. These same 12 monitoring wells will be purged and sampled during the second sampling event.

A submersible pump will be used to purge the monitoring wells using low-flow sampling techniques. Field parameters, which include temperature, pH, specific conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP) and turbidity of the samples, will be recorded during the purging process. After a minimum of 30 minutes of purging and after the field parameters have stabilized, water samples will be collected directly from the pump effluent. The purge water generated will be containerized and staged at an on-site location designated by NYSEG.

A total of twelve groundwater samples will be collected from the new and existing monitoring wells. The samples for VOCs and natural attenuation parameters will be collected immediately following purging. At this time, we have assumed that only unfiltered samples will be collected.

As shown in Table 8, the twelve groundwater samples will be analyzed for TCL VOCs (USEPA Method 8260B), TCL SVOCs (USEPA Method 8270C), TCL PCBs (USEPA Method 8082), total phenols (USEPA Method 9065), TAL metals (USEPA Methods 6010B/7471A/7470A), and total cyanide (USEPA Method 9012A). An aliquot of groundwater from each well will be sent to the laboratory to be archived for potential additional cyanide analyses. If total cyanide is detected in groundwater, then free cyanide analysis and cyanide by speciation will be performed on the archived aliquot. The laboratory will complete total cyanide analyses within 7 days so that free cyanide and cyanide speciation determinations can be completed within holding times. Groundwater samples will also be analyzed for alkalinity (USEPA Method 310.1), chloride (USEPA Method 300.0), nitrate/nitrite (USEPA Method 300.0), sulfate/sulfide (USEPA Method 300.0/376.2), dissolved iron (USEPA Method 6010B), ferrous iron, and total dissolved solids (USEPA Method 160.1). Selected samples will be analyzed for extended PAHs (modified USEPA Method 8270C). The analytical data generated from groundwater sampling will be reported by the laboratory with ASP Category B QA/QC deliverables. The groundwater sampling procedures are described in the *FSP* (Appendix C) and *QAPP*.

4.4 TASK 4 – TEST TRENCHES

Five test trenches (TT-01 through TT-05) will be excavated around the inside perimeter of the site and two trenches (TT-06 and TT-07) will be excavated near the center of the site. The purpose of these test trenches is to visually inspect the water table for evidence of contamination, if any, and to further characterize the soil. Furthermore, the two trenches near the center of the site will aid in determining the location of former piping connecting former MGP structures, which may act as a conduit for contaminant migration. The locations of these trenches are shown on Figure 8 and described in Table 7. The trenches will be excavated to approximately 20 feet long and extend to just below the water table at a depth of approximately 4 feet bgs. If grossly contaminated soil is encountered in any of the test trenches, the soil will be left exposed for visual inspection and not excavated from the subsurface. Immediately following the inspection of each test trench, the trenches will be backfilled. If it is determined that additional investigation is necessary to gain information below the bottom of the test trench, then following

consultation with NYSDEC, a soil boring may be advanced to complete the vertical characterization near the test trench location.

Photographs will be taken of each test trench to document the subsurface conditions encountered. One soil sample will be collected at each trench location from the area exhibiting the highest level of contamination based on field screening.

As shown in Table 8, the seven soil samples will be analyzed for BTEX (USEPA Method 8260B), TCL SVOCs (USEPA Method 8270C), extended PAHs (modified USEPA Method 8270C), TCL PCBs (USEPA Method 8082), total phenols (USEPA Method 9065), TAL metals (USEPA Methods 6010B/7471A/7470A), and total cyanide (SW 9012A, free cyanide ASTM D 4282-02), and cyanide by speciation (Wallschlager), ferrous and ferric cyanide, TOC (Lloyd Kahn), and NOD. One soil sample will be analyzed for reactivity, total sulfur, and TCLP benzene (USEPA Method 1311/8260B). The analytical data generated from soil samples collected during the test trenching will be reported by the laboratory with ASP Category B QA/QC deliverables.

4.5 TASK 5 – SURFACE WATER AND SEDIMENT SAMPLING

URS will complete a sediment probing program in the Owasco Outlet to obtain data regarding sediment thickness, vertical profiles with respect to sediment composition, and olfactory or visual evidence of impacts, if any, at transects upstream, adjacent to, and downstream of the former MGP site. URS will probe the bottom of the stream at four approximately equidistant intervals with one probe near each bank at transects less than approximately 60-feet long. URS will probe the bottom of the stream at five approximately equidistant intervals with one probe near each bank at transects greater than approximately 60-feet long.

URS will record observations regarding stream characteristics, textural classification of the sediments, and any potential non-MGP sources of contamination. As shown on Figure 8, these transects will be at 100 foot intervals beginning 500 feet upstream and extending to 500 feet downstream of the site. Any sheens, tar or NAPL blebs, globules or any other indications of

product will be noted in the logbook. Sediment thickness, water depth, and stream water velocity will be measured and noted.

In order to assess potential impacts on sediment and surface water in the Owasco Outlet, a minimum of five surface water and 11 sediment samples, including one near-shore sediment sample, will be collected. One stream-bank surface soil sample will also be collected as part of this task.

As presented on Figure 8 and described in Table 7, the proposed sediment sampling locations will be based upon the stream characterization and sediment probing. Final locations will be established after consultation with NYSEG and NYSDEC. Samples will be collected from any areas where sheens are observed, in places of sediment accumulation, riffle/run areas upstream, adjacent to, and downstream of the site. Surface water samples will be collected upstream, adjacent to, and downstream of the site. Three of the five surface water samples will be collected adjacent to the site. The surface water and sediment samples will be collected from the farthest downgradient location first and subsequent samples collected progressively upstream.

At a minimum, ten sediment samples from the uppermost depth interval (0 to 0.5 feet) from the ten cores are planned to be collected for laboratory analysis. Core samples will be collected by driving a two-inch Lexan tube into the sediment up to three feet below the stream bed surface or to refusal. The core will be segmented into intervals of 0 to 0.5 feet, 0.5 to 1.0 feet, 1 to 2 feet, and 2 to 3 feet or increments defined in the field by notable changes in stratigraphy or contamination. The uppermost depth interval (0 to 0.5 feet) will be analyzed for the parameters noted in Table 8. The remaining core segments will be retained for potential analyses. The remaining core segments (greater than 0.5 feet) may be analyzed if the 0 to 0.5 foot sample exhibits MGP impacts upon inspection in the field or if the laboratory analytical results from the 0 to 0.5 foot sample indicate elevated concentration of MGP contaminants.

As shown in Table 8, a minimum of ten sediment samples will be analyzed for BTEX (USEPA Method 8260B), TCL SVOCs (USEPA Method 8270C), TCL PCBs (USEPA Method 8082), total phenols (USEPA Method 9065), TAL metals (USEPA Methods 6010B/7471A/7470A), and

total cyanide (SW 9012A), and TOC (Lloyd Kahn). Selected samples will be analyzed for extended PAHs (modified USEPA Method 8270C), free cyanide (ASTM D 7282-02), and cyanide by speciation (Wallschlager) ferrous and ferric cyanide. Selected samples will be analyzed for an expanded SVOC list by META Environmental Services, Inc. of Watertown, Massachusetts. The five surface water samples will be analyzed for the same parameters with the exception of BTEX, ferrous and ferric cyanide, and TOC and the addition of TCL VOCs (USEPA Method 8260B). The analytical data generated from surface water and sediment sampling will be reported by the laboratory with ASP Category B QA/QC deliverables. The surface water and sediment sampling procedures are described in the *FSP* and *QAPP*.

Selected sediment samples will be analyzed for hydrocarbon fingerprinting and extended PAH profiles by Meta Environmental Services, Inc. (Meta) of Watertown, Massachusetts. As presented in Section 4.1 two soil samples will be collected from source areas (i.e., where NAPLS or MGP residuals are encountered) will be analyzed for hydrocarbon fingerprinting and extended PAH profiles by Meta.

For the purposes of this workplan, a minimum of three sediment samples will be submitted to Meta. These sediment samples will be analyzed for hydrocarbon fingerprint by EPA Method 8100 and extended PAH profiles by modified EPA Method 8270 to evaluate whether some of the PAHs in the sediment originated from sources upgradient of the former MGP site. The purpose of these environmental forensic parameter analyses is to evaluate whether there are sources other than the former MGP site for the PAHs found in the sediment in the Owasco Outlet. The selected samples will be from locations upgradient, adjacent to, and downstream of the site and the number of samples to be submitted to Meta will be dependent upon the results of the sediment probing program. The sediment samples will be analyzed for selected environmental forensic parameters to separate hydrocarbon impacts from a former MGP operation from similar chemicals from other sources and urban background. The ratios of the PAHs from the sediment samples will be compared to the ratios of the PAHs from various tar samples from Meta's in-house source library, that include coke oven tar, coal carbonization tar, and carburetted water gas tar.

According to the May 1991 Site Screening Report, there is a public access point to the Owasco Outlet opposite the NYSEG site. One streambank surface soil sample and one near shore sediment sample will be collected from the public access area as part of this task. The proposed surface soil and sediment sampling location is identified as ST-01 on Figure 8. These two samples will be analyzed for the same parameters listed for the ten sediment samples that will be collected from the Owasco Outlet.

Furthermore, a supplemental evaluation of the properties up to 0.5 miles upstream from the site along the Owasco Lake Outlet will be conducted. This reconnaissance will evaluate the current and historic character of these properties with respect to potential contribution of contamination to the Owasco Lake Outlet. During this evaluation, field staff will conduct visual observations of these properties, review historic aerial photographs, Sanborn maps, and other historic documents that may be available from the Cayuga County Historical Society and the City of Auburn. In addition, field observations will identify the locations of any other potential point source(s) such as storm sewer or other discharges, and gas stations upstream of the site.

4.6 TASK 6 – FISH AND WILDLIFE IMPACT ANALYSIS

URS proposes to conduct a Fish and Wildlife Impact Analysis (FWIA) for the site. The FWIA will be performed in accordance with the NYSDEC Division of Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (1994). The FWIA will be completed using the following steps:

- Step I of the Fish and Wildlife Impact Analysis (FWIA) includes a detailed site description, description of fish and wildlife resources, fish and wildlife resource values, and applicable fish and wildlife regulatory criteria.
- Step IIA, the pathways analysis, involves the identification of pathways of contaminant migration and fish and wildlife exposure to these contaminants. If no significant resources or potential pathways are present, the impact on resources can be considered minimal. Furthermore, if field studies can demonstrate that no migration is occurring along the potential pathway, impact to fish and wildlife resources can be considered minimal.

- Step IIB, criteria-specific analysis, will be conducted for all pathways that are determined to be potentially complete. Estimated exposure-point concentrations will be compared to applicable numerical criteria for each contaminant of concern in each of the potentially completed pathways. If exposure-point concentrations for any completed pathway exceed the applicable criteria, then NYSEG will have the option to implement risk reduction remedies or conduct further, more detailed studies to support a baseline risk assessment.

4.7 TASK 7 – QUALITATIVE RISK ASSESSMENT

URS will conduct a qualitative human health risk assessment (HRA) to evaluate potential risks to human health associated with potential exposure to site media. The assessment will be completed in accordance with the NYSDEC's *DER – 10 Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2002). The assessment will provide an evaluation of potential adverse health effects that may result from exposure to contaminants attributable to historic activities at the site, under current and potential future site conditions. The qualitative HRA will include three of the four components established in USEPA's Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1989). Because the assessment is qualitative, it will not include the risk characterization component. The three components are: 1) Identification of Chemicals of Potential Concern; 2) Exposure Assessment; and 3) Toxicity Assessment.

4.8 TASK 8 – ANALYZE DATA AND PREPARE REPORT

URS will perform data analysis throughout the project, which will be facilitated using a geographic information system (GIS). URS developed a proprietary environmental database management system used to manage large and complex data sets for geological, hydrogeological, hydraulic, geochemical, and compliance data. The database management system is linked to geographical position of all sampling points through GIS software packages. This system was designed by URS to efficiently capture, store, update, manipulate, analyze, and display all forms of referenced information. If necessary, this system can be used in conjunction with various software packages such as BOSS GMS. This software allows URS to display site information

and can be used as predictive tool for predictive modeling of site contaminants. Predictive modeling is not included in this scope of work.

If, during the course of the field investigation, the data indicates that the scope of work should be modified, we will immediately notify NYSEG. At NYSEG's direction, the information will also be conveyed to NYSDEC. We believe that this interactive process with NYSEG and the NYSDEC, which we are effectively using at NYSEG's Mechanicville and Geneva-Border City Sites, will produce sound technical results in a timely and cost-effective manner. Any variations in the scope of work or recommendations to change the scope of work will also be documented in the weekly progress reports that will be transmitted via email to the NYSEG project manager and the NYSDEC.

After URS completes the scope of work, we will prepare two copies of a draft report within ten (10) weeks of completion of the fieldwork. Supporting data, including the analytical data, boring logs, and field notes will be included in the draft report. A photograph log of the field effort, particularly during test trenches, will also be included into the report.

The report will include a thorough summary of the background information and investigative procedures. The geology and hydrogeology section of the report will be based on a literature review and the results of the previous and recent site investigations. The physical characteristics of the soils will also be described.

Geologic cross-sections will also be developed. Where available from published reports, the cross-sections will include off-site data concerning subsurface conditions. The sources of MGP-related contamination will be described in a section on source characterization. Figures showing 2-D and 3-D conceptual site models delineating MGP residuals in soil and groundwater will be included. Any other potential sources and potential preferential contaminant migration pathways that we identify will also be described and integrated into the conceptual site model.

The report will include a discussion of the analytical data collected during the SRI and previous investigations. URS will prepare plan view isoconcentration maps and cross-sections that show

the approximate extent of contamination. These figures will show both vertical and horizontal extent of specific contaminants, or suites of contaminants, that are present above applicable regulatory criteria or guidance values. All groundwater data including the historical data will be assessed using the non-parametric Mann-Kendall test for trend analysis, an advanced statistical method used to determine changes in concentrations over time.

URS will prepare a list of the conclusions that are based on our background review, our geologic and hydrogeologic interpretation, the analytical data, a qualitative human health risk assessment, fish and wildlife assessment, conclusions and recommendations.

The final report will be provided in pdf format in addition to a hard copy.

5.0 SCHEDULE

Figure 9 is a tentative schedule to implement the scope of work described in Section 4.0. Some sampling activities will require access agreements with private and State agencies. NYSEG will arrange for all private site access, and URS will seek all permits and site access agreements for State owned properties. This schedule is flexible and NYSDEC and URS will work with all of the parties to complete this project as efficiently as possible.

6.0 REFERENCES

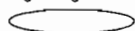
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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-01	MW-01	MW-01	MW-01	MW-01
Sample ID			MW-01	MW-01	MW-01	MW-9201	ACGUSH9201
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Volatile Organic Compounds							
Acetone	UG/L	50	10 U	NA	NA	NA	NA
Benzene	UG/L	1	5 U	0.5 U	0.5 U	0.5 U	0.2 U
Ethylbenzene	UG/L	5	5 U	0.5 U	0.5 U	0.5 U	0.2 U
m&p-Xylene	UG/L	5	NA	NA	0.5 U	0.5 U	NA
Methylene chloride	UG/L	5	5 U	NA	0.5 U	NA	NA
o-Xylene	UG/L	5	NA	NA	0.5 U	0.5 U	NA
Toluene	UG/L	5	5 U	0.5 U	0.5 U	0.5 U	0.2 U
Xylene (total)	UG/L	5	5 U	0.5 U	NA	NA	0.2 U
Total Volatile Organic Compounds	UG/L	-	ND	ND	ND	ND	ND
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50	10 U	10 U	10 U	10 U	NA
2-Methylnaphthalene	UG/L	-	10 U	10 U	10 U	10 U	NA
4-Methylphenol (p-cresol)	UG/L	1	10 U	10 U	10 U	10 U	NA
Acenaphthene	UG/L	20	10 U	10 U	10 U	10 U	2 UJ
Acenaphthylene	UG/L	50	10 U	10 U	10 U	10 U	2 UJ
Anthracene	UG/L	50	10 U	10 U	10 U	10 U	2 UJ
Benzo(a)anthracene	UG/L	0.002	10 U	10 U	10 U	10 U	2 UJ
Benzo(a)pyrene	UG/L	ND	10 U	10 U	10 U	10 U	2 UJ
Benzo(b)fluoranthene	UG/L	0.002	10 U	10 U	10 U	10 U	2 UJ
Benzo(g,h,i)perylene	UG/L	50	10 U	10 U	10 U	10 U	2 UJ
Benzo(k)fluoranthene	UG/L	0.002	10 U	10 U	10 U	10 U	2 UJ
bis(2-Ethylhexyl)phthalate	UG/L	5	10 U	10 U	10 U	10 U	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

Flags assigned during chemistry validation are shown.



Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

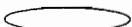
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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-01	MW-01	MW-01	MW-01	MW-01
Sample ID			MW-01	MW-01	MW-01	MW-9201	ACGUSH9201
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Semivolatile Organic Compounds							
Carbazole	UG/L	50	NA	NA	NA	10 U	NA
Chrysene	UG/L	0.002	10 U	10 U	10 U	10 U	2 UJ
Dibenz(a,h)anthracene	UG/L	50	10 U	10 U	10 U	10 U	2 UJ
Dibenzofuran	UG/L	50	10 U	10 U	10 U	10 U	NA
Fluoranthene	UG/L	50	10 U	1 J	10 U	10 J	2 UJ
Fluorene	UG/L	50	10 U	10 U	10 U	10 U	2 UJ
Indeno(1,2,3-cd)pyrene	UG/L	0.002	10 U	10 U	10 U	10 U	2 UJ
Naphthalene	UG/L	10	10 U	10 U	10 U	10 U	2 UJ
Nitrobenzene	UG/L	0.4	10 U	NA	10 U	10 U	NA
Phenanthrene	UG/L	50	10 U	1 J	10 U	10 U	2 UJ
Phenol	UG/L	1	10 U	10 U	10 U	10 U	NA
Pyrene	UG/L	50	10 U	10 U	10 U	10 U	2 UJ
Total Carcinogenic PAHs	UG/L	-	ND	ND	ND	ND	ND
Total Non-Carcinogenic PAHs	UG/L	-	ND	2	ND	10	ND
Total Polynuclear Aromatic Hydrocarbons	UG/L	-	ND	2	ND	10	ND
Total Semivolatile Organic Compounds	UG/L	-	ND	2	ND	10	ND
Metals							
Aluminum	UG/L	-	78,400	78,600	40,300	22,000	9,100
Antimony	UG/L	3	25 J	3 U	3 U	5 U	2 U
Arsenic	UG/L	25	30.4	54.1	29.9	2 U	33
Barium	UG/L	1000	1,150	1,000	598	531	280
Cadmium	UG/L	5	49	5	9	0.4 U	5 U

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-01	MW-01	MW-01	MW-01	MW-01
Sample ID			MW-01	MW-01	MW-01	MW-9201	ACGUSH9201
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Metals							
Chromium	UG/L	50	163	158	75	48	71
Copper	UG/L	200	415	394	199	111	34
Iron	UG/L	300	141,000	136,000	71,400	41,200	NA
Lead	UG/L	25	153	121	77	44.5	18
Manganese	UG/L	300	4,460	3,860	2,800	2,520	NA
Mercury	UG/L	0.7	0.48	0.67	0.22	0.1 U	0.2 U
Nickel	UG/L	100	252	228	119	56	26
Selenium	UG/L	10	20 U	2 U	2.2 J	1.7 J	16
Silver	UG/L	50	5 U	6 U	6 U	7 U	10 U
Vanadium	UG/L	-	172	189	107	52	13
Zinc	UG/L	2000	539	485	248	162	62
Miscellaneous Parameters							
Cyanide	MG/L	-	0.01 U	13	0.01 U	0.01 U	0.02 U
Cyanide, Amenable To Chlorination	MG/L	-	NA	NA	NA	NA	0.02 U
pH	S.U.	-	NA	NA	NA	NA	7

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-02	MW-02	MW-02	MW-02	MW-02
Sample ID			MW-02	MW-02	MW-02	MW-02	ACGUSH9202
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Volatile Organic Compounds							
Acetone	UG/L	50	10 U	NA	NA	NA	NA
Benzene	UG/L	1	5 U	1.3	0.5	0.5 U	0.2 U
Ethylbenzene	UG/L	5	5 U	0.5 U	0.5 U	0.5 U	0.2 U
m&p-Xylene	UG/L	5	NA	NA	0.5 U	0.5 U	NA
Methylene chloride	UG/L	5	5 U	NA	0.5 U	NA	NA
o-Xylene	UG/L	5	NA	NA	0.5 U	0.5 U	NA
Toluene	UG/L	5	5 U	0.5 U	0.5 U	0.5 U	0.2 U
Xylene (total)	UG/L	5	5 U	0.5 U	NA	NA	0.2 U
Total Volatile Organic Compounds	UG/L	-	ND	1.3	0.5	ND	ND
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50	10 U	10 U	10 U	13 U	NA
2-Methylnaphthalene	UG/L	-	10 U	10 U	10 U	13 U	NA
4-Methylphenol (p-cresol)	UG/L	1	10 U	10 U	10 U	13 U	NA
Acenaphthene	UG/L	20	10 U	0.8 J	10 U	13 J	2 UJ
Acenaphthylene	UG/L	50	10 U	10 U	10 U	13 U	2 UJ
Anthracene	UG/L	50	10 U	10 U	10 U	13 U	2 UJ
Benzo(a)anthracene	UG/L	0.002	10 U	10 U	10 U	13 U	2 UJ
Benzo(a)pyrene	UG/L	ND	10 U	10 U	10 U	13 U	2 UJ
Benzo(b)fluoranthene	UG/L	0.002	10 U	10 U	10 U	13 U	2 UJ
Benzo(g,h,i)perylene	UG/L	50	10 U	10 U	10 U	13 U	2 UJ
Benzo(k)fluoranthene	UG/L	0.002	10 U	10 U	10 U	13 U	2 UJ
bis(2-Ethylhexyl)phthalate	UG/L	5	4 J	10 U	10 U	13 U	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-02	MW-02	MW-02	MW-02	MW-02
Sample ID			MW-02	MW-02	MW-02	MW-0202	ACGUSH9202
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Semivolatile Organic Compounds							
Carbazole	UG/L	50	NA	NA	NA	13 U	NA
Chrysene	UG/L	0.002	10 U	10 U	10 U	13 U	2 UJ
Dibenz(a,h)anthracene	UG/L	50	10 U	10 U	10 U	13 U	2 UJ
Dibenzofuran	UG/L	50	10 U	10 U	10 U	13 U	NA
Fluoranthene	UG/L	50	10 U	10 U	10 U	13 U	2 UJ
Fluorene	UG/L	50	10 U	10 U	10 U	13 U	2 UJ
Indeno(1,2,3-cd)pyrene	UG/L	0.002	10 U	10 U	10 U	13 U	2 UJ
Naphthalene	UG/L	10	10 U	10 U	10 U	13 U	2 UJ
Nitrobenzene	UG/L	0.4	10 U	NA	10 U	13 U	NA
Phenanthrene	UG/L	50	10 U	10 U	10 U	13 U	2 UJ
Phenol	UG/L	1	10 U	10 U	10 U	13 U	NA
Pyrene	UG/L	50	1 J	10 U	10 U	13 U	2 UJ
Total Carcinogenic PAHs	UG/L	-	ND	ND	ND	ND	ND
Total Non-Carcinogenic PAHs	UG/L	-	1	0.8	ND	13	ND
Total Polynuclear Aromatic Hydrocarbons	UG/L	-	1	0.8	ND	13	ND
Total Semivolatile Organic Compounds	UG/L	-	5	0.8	ND	13	ND
Metals							
Aluminum	UG/L	-	63,200	33,000	20,900	24,200	9,200
Antimony	UG/L	3	6.2 J	3 U	3 U	5 U	5
Arsenic	UG/L	25	40.3	24.9	12.6	2 U	17
Barium	UG/L	1000	522	324	216	266	110
Cadmium	UG/L	5	34	4 J	6	0.4 U	5 U

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

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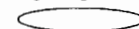
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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-02	MW-02	MW-02	MW-02	MW-02
Sample ID			MW-02	MW-02	MW-02	MW-9202	ACGUSH9202
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Metals							
Chromium	UG/L	50	187	157	83	87	29
Copper	UG/L	200	236	142	71	103	19
Iron	UG/L	300	108,000	69,700	35,900	51,100	NA
Lead	UG/L	25	96.5	51.5	29	39.2	22
Manganese	UG/L	300	3,830	2,990	2,090	2,230	NA
Mercury	UG/L	0.7	2	0.13 J	0.1 U	0.12 J	0.2 U
Nickel	UG/L	100	193	129	69	56	25
Selenium	UG/L	10	2.8 J	2 U	2.2 J	1.9 J	15
Silver	UG/L	50	7	6 U	6 U	7 U	10 U
Vanadium	UG/L	-	127	82	60	54	13
Zinc	UG/L	2000	472	283	138	204	58
Miscellaneous Parameters							
Cyanide	MGL	-	0.01 U	0.1 U	0.0109	0.01 U	0.12
Cyanide, Amenable To Chlorination	MGL	-	NA	NA	0.0109	NA	0.1
pH	S.U.	-	NA	NA	NA	NA	7.5

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

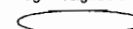
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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-03	MW-03	MW-03	MW-03	MW-03
Sample ID			MW-03	MW-03	MW-03	MW-9203	ACGDSH9203
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Volatile Organic Compounds							
Acetone	UG/L	50	10 U	NA	NA	NA	NA
Benzene	UG/L	1	3 J	1.3	47	3.6	0.2 U
Ethylbenzene	UG/L	5	7	5.6	2.2	4.1	0.2 U
m&p-Xylene	UG/L	5	NA	NA	0.7	1.3	NA
Methylene chloride	UG/L	5	5 U	NA	0.5 U	NA	NA
o-Xylene	UG/L	5	NA	NA	2.2	23	NA
Toluene	UG/L	5	5 U	0.5 U	0.7	0.5 U	0.2 U
Xylene (total)	UG/L	5	5	5.3	NA	NA	0.2 U
Total Volatile Organic Compounds	UG/L	-	15	12.2	52.8	32	ND
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50	11 U	10 U	12 U	10 U	NA
2-Methylnaphthalene	UG/L	-	95	15	12 U	2 J	NA
4-Methylphenol (p-cresol)	UG/L	1	11 U	10 U	4 J	10 U	NA
Acenaphthene	UG/L	20	130	58	28	36	2 UJ
Acenaphthylene	UG/L	50	14	16	3 J	5 J	2 UJ
Anthracene	UG/L	50	50	63	7 J	15	2 UJ
Benzo(a)anthracene	UG/L	0.002	27	45	12 U	9 J	2 UJ
Benzo(a)pyrene	UG/L	ND	23	41	4 J	8 J	2 UJ
Benzo(b)fluoranthene	UG/L	0.002	9 J	37	3 J	4 J	2 UJ
Benzo(g,h,i)perylene	UG/L	50	11 J	14	12 U	10 U	2 UJ
Benzo(k)fluoranthene	UG/L	0.002	13	14	12 U	5 J	2 UJ
bis(2-Ethylhexyl)phthalate	UG/L	5	2 J	2 J	12 U	10 U	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: GROUNDWATER
 N:\11173291 00000\IDB\Program\Program.mde
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 [MATRIX] = 'WG'

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-03	MW-03	MW-03	MW-03	MW-03
Sample ID			MW-03	MW-03	MW-03	MW-9203	ACGDSH9203
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Semivolatile Organic Compounds							
Carbazole	UG/L	50	NA	NA	NA	10 U	NA
Chrysene	UG/L	0.002	37	41	5 J	10	2 UJ
Dibenz(a,h)anthracene	UG/L	50	11 U	4 J	12 U	10 U	2 UJ
Dibenzofuran	UG/L	50	4 J	10 U	12 U	0.8 J	NA
Fluoranthene	UG/L	50	56	80	1 J	17	2 UJ
Fluorene	UG/L	50	78	32	9 J	15	2 UJ
Indeno(1,2,3-cd)pyrene	UG/L	0.002	11 U	15	12 U	4 J	2 UJ
Naphthalene	UG/L	10	200	64	12 U	95	2 UJ
Nitrobenzene	UG/L	0.4	11 U	NA	12 U	10 U	NA
Phenanthrene	UG/L	50	190	120	8 J	39	2 UJ
Phenol	UG/L	1	11 U	10 U	12 U	10 U	NA
Pyrene	UG/L	50	82	100	13	22	2 UJ
Total Carcinogenic PAHs	UG/L	-	109	197	12	40	ND
Total Non-Carcinogenic PAHs	UG/L	-	811	547	69	244	ND
Total Polynuclear Aromatic Hydrocarbons	UG/L	-	920	744	81	284	ND
Total Semivolatile Organic Compounds	UG/L	-	1,021	761	85	286.8	ND
Metals							
Aluminum	UG/L	-	30,000	10,000	6,100	7,220	620
Antimony	UG/L	3	1.3 J	3 U	3.1 J	5 U	2 U
Arsenic	UG/L	25	24.5	15.5	11.4	17.7	4
Barium	UG/L	1000	315	132	141 J	152 J	70
Cadmium	UG/L	5	29	4 U	0.4 U	0.4 U	5 U

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: GROUNDWATER
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[MATRIX] = 'WG'

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-03	MW-03	MW-03	MW-03	MW-03
Sample ID			MW-03	MW-03	MW-03	MW-9203	ACGDSH9203
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*					
Metals							
Chromium	UG/L	50	79	34	23	28	10 U
Copper	UG/L	200	186	75	61	87	10 U
Iron	UG/L	300	59,800	24,500	16,200	19,300	NA
Lead	UG/L	25	158	39.3	24.3	32.4	6
Manganese	UG/L	300	2,330	724	954	856	NA
Mercury	UG/L	0.7	0.44	0.1 U	0.1 U	0.1 U	0.2 U
Nickel	UG/L	100	135	51	44	25 J	20 U
Selenium	UG/L	10	2 U	2 U	2 U	1.5 J	9 U
Silver	UG/L	50	5 U	6 U	6 U	7 U	10 U
Vanadium	UG/L	-	67	20 J	28 J	19 J	10 U
Zinc	UG/L	2000	339	142	88	103	19
Miscellaneous Parameters							
Cyanide	MG/L	-	0.249	0.585	0.149	0.193	0.41
Cyanide, Amenable To Chlorination	MG/L	-	0.026	0.017	0.01 U	0.01 U	0.06
pH	S.U.	-	NA	NA	NA	NA	7.5

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

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U - Not detected above the reported quantitation limit.

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Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: GROUNDWATER
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Printed: 10/14/04 11:28:52 AM
[MATRIX] = 'WG'

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-04	MW-04	MW-04	MW-04	MW-04
Sample ID			MW-04	MW-04	MW-04	MW-04	MW-04DUP
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	03/18/93	06/04/93	06/04/93
Parameter	Units	Criteria*			Field Duplicate (1-1)		Field Duplicate (1-1)
Volatile Organic Compounds							
Acetone	UG/L	50	100 U	NA	NA	NA	NA
Benzene	UG/L	1	1,700	2,200	2,300	1,700	2,000
Ethylbenzene	UG/L	5	1,400	1,300	1,500	1,200	1,300
m&p-Xylene	UG/L	5	NA	NA	NA	220	280
Methylene chloride	UG/L	5	50 U	NA	NA	25 U	25 B
o-Xylene	UG/L	5	NA	NA	NA	270	300
Toluene	UG/L	5	37 J	52	52	33	48
Xylene (total)	UG/L	5	580	780	820	NA	NA
Total Volatile Organic Compounds	UG/L	-	3,717	4,332	4,672	3,423	3,953
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50	48 U	48 U	48 U	10 U	10 U
2-Methylnaphthalene	UG/L	-	360	390 D	350 D	140	150
4-Methylphenol (p-cresol)	UG/L	1	48 U	48 U	48 U	10 U	10 U
Acenaphthene	UG/L	20	250	290 D	260 D	92	95
Acenaphthylene	UG/L	50	16 J	25 D	18 JD	8 J	10
Anthracene	UG/L	50	36 J	62 D	36 JD	17	19
Benzo(a)anthracene	UG/L	0.002	48 U	48 D	26 JD	10 U	10 U
Benzo(a)pyrene	UG/L	ND	48 U	46 JD	23 JD	6 J	12
Benzo(b)fluoranthene	UG/L	0.002	48 U	35 JD	17 JD	6 J	10
Benzo(g,h,i)perylene	UG/L	50	48 U	22 JD	48 U	4 J	6 J
Benzo(k)fluoranthene	UG/L	0.002	48 U	48 U	48 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	UG/L	5	48 U	48 U	48 U	2 J	10 U

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

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Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: GROUNDWATER
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 [MATRIX] = WG'

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-04	MW-04	MW-04	MW-04	MW-04
Sample ID			MW-04	MW-04	MW-04	MW-04	MW-04DUP
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	03/18/93	06/04/93	06/04/93
Parameter	Units	Criteria*			Field Duplicate (1-1)		Field Duplicate (1-1)
Semivolatile Organic Compounds							
Carbazole	UG/L	50	NA	NA	NA	NA	NA
Chrysene	UG/L	0.002	48 U	43 JD	22 JD	8 J	10
Dibenz(a,h)anthracene	UG/L	50	48 U	48 U	48 U	10 U	10 U
Dibenzofuran	UG/L	50	7 J	8 JD	7 JD	2 J	2 J
Fluoranthene	UG/L	50	49	95 D	53 D	22	28
Fluorene	UG/L	50	89	90 D	74 D	30	32
Indeno(1,2,3-cd)pyrene	UG/L	0.002	48 U	20 JD	20 D	3 J	5 J
Naphthalene	UG/L	10	48 U	5,500 D	5,500 D	3,200 D	3,300 D
Nitrobenzene	UG/L	0.4	2,500	NA	NA	10 U	10 U
Phenanthrene	UG/L	50	190	260 D	180 D	70	77
Phenol	UG/L	1	48 U	17 JD	17 JD	14	10 U
Pyrene	UG/L	50	86	130 D	72	28	36
Total Carcinogenic PAHs	UG/L	-	ND	192	108	23	37
Total Non-Carcinogenic PAHs	UG/L	-	716	6,474	6,193	3,471	3,603
Total Polynuclear Aromatic Hydrocarbons	UG/L	-	716	6,666	6,301	3,494	3,640
Total Semivolatile Organic Compounds	UG/L	-	3,583	7,081	6,675	3,652	3,792
Metals							
Aluminum	UG/L	-	21,200	15,600	15,900	16,500	14,000
Antimony	UG/L	3	1 U	3 U	3 U	3 U	3 U
Arsenic	UG/L	25	17.4	15.8	14.4	10	9.4 J
Barium	UG/L	1000	621	483	518	481	470
Cadmium	UG/L	5	28	4 J	4 U	0.4 U	0.4 U

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

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TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-04	MW-04	MW-04	MW-04	MW-04
Sample ID			MW-04	MW-04	MW-04	MW-04	MW-04DUP
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/01/92	03/18/93	03/18/93	06/04/93	06/04/93
Parameter	Units	Criteria*			Field Duplicate (1-1)		Field Duplicate (1-1)
Metals							
Chromium	UG/L	50	60	38	47	26	22
Copper	UG/L	200	104	66	75	54	55
Iron	UG/L	300	41,300	32,400	33,700	27,100	23,700
Lead	UG/L	25	32.4	31.6	26.5	21.1	25.5
Manganese	UG/L	300	1,610	1,520	1,510	1,000	960
Mercury	UG/L	0.7	0.12 J	0.1 U	0.13 J	0.1 U	0.1 U
Nickel	UG/L	100	80	57	67	41	35 J
Selenium	UG/L	10	2 U	2 U	2 U	2 U	2 U
Silver	UG/L	50	5 U	6 U	6 U	6 U	6 U
Vanadium	UG/L	-	41 J	34 J	33 J	47 J	43 J
Zinc	UG/L	2000	135	91	94	94	124
Miscellaneous Parameters							
Cyanide	MGL	-	0.0511	0.0689	0.0717	0.0591	0.056
Cyanide, Amenable To Chlorination	MGL	-	0.01 U	0.017	1.2 U	0.0059	0.01 U
pH	S.U.	-	NA	NA	NA	NA	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

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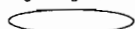
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[MATRIX] = 'WG'

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-04	MW-04	MW-04	MW-05	MW-05
Sample ID			MW-9204	MW-9204DUP	ACGDSH9204	MW-05	MW-05DUP
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			09/21/93	09/21/93	10/31/96	12/01/92	12/01/92
Parameter	Units	Criteria*	Field Duplicate (1-1)				Field Duplicate (1-1)
Volatile Organic Compounds							
Acetone	UG/L	50	NA	NA	NA	330 U	4,100
Benzene	UG/L	1	2,400	2,300	726	3,900	170 U
Ethylbenzene	UG/L	5	1,600	1,600	691	1,900	1,400
m&p-Xylene	UG/L	5	370	380	NA	NA	NA
Methylene chloride	UG/L	5	NA	NA	NA	170 U	170 U
o-Xylene	UG/L	5	420	420	NA	NA	NA
Toluene	UG/L	5	38	38	10 U	170 U	170 U
Xylene (total)	UG/L	5	NA	NA	177	210	220
Total Volatile Organic Compounds	UG/L	-	4,828	4,738	1,594	6,010	5,720
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50	10 U	10 U	NA	3 J	3 J
2-Methylnaphthalene	UG/L	-	310	300	NA	130	130
4-Methylphenol (p-cresol)	UG/L	1	10 U	10 U	NA	10 U	10 U
Acenaphthene	UG/L	20	170	16	50.4 J	170	170
Acenaphthylene	UG/L	50	16	11	5.25 J	10 U	10 U
Anthracene	UG/L	50	23	12	8.58 J	2 J	10 U
Benzo(a)anthracene	UG/L	0.002	22	8 J	6.51 J	10 U	10 U
Benzo(a)pyrene	UG/L	ND	22	7 J	11.6 J	10 U	10 U
Benzo(b)fluoranthene	UG/L	0.002	12	4 J	15 J	10 U	10 U
Benzo(g,h,i)perylene	UG/L	50	11	10 U	6.72 J	10 U	10 U
Benzo(k)fluoranthene	UG/L	0.002	8 J	3 J	5.69 J	10 U	10 U
bis(2-Ethylhexyl)phthalate	UG/L	5	10 U	10 U	NA	10 U	10 U

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

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NA - Not Analyzed, ND - Not Detected

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J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

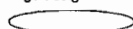
Detection Limits shown are MDL

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-04	MW-04	MW-04	MW-05	MW-05
Sample ID			MW-9204	MW-9204DUP	ACGDSH9204	MW-05	MW-05DUP
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			09/21/93	09/21/93	10/31/96	12/01/92	12/01/92
Parameter	Units	Criteria*		Field Duplicate (1-1)			Field Duplicate (1-1)
Semivolatile Organic Compounds							
Carbazole	UG/L	50	6 J	5 J	NA	NA	NA
Chrysene	UG/L	0.002	20	7 J	7.28 J	10 U	10 U
Dibenz(a,h)anthracene	UG/L	50	10 U	10 U	2 UJ	10 U	10 U
Dibenzofuran	UG/L	50	5 J	5 J	NA	5 J	5 J
Fluoranthene	UG/L	50	42	20	20.2 J	10 U	10 U
Fluorene	UG/L	50	48	41	12.8 J	34	36
Indeno(1,2,3-cd)pyrene	UG/L	0.002	11	4 J	5.5 J	10 U	10 U
Naphthalene	UG/L	10	5,200 D	5,200 D	1,170 J	1,600	1,600
Nitrobenzene	UG/L	0.4	10 U	10 U	NA	10 U	10 U
Phenanthrene	UG/L	50	94	67	24 J	21	22
Phenol	UG/L	1	10 U	10 U	NA	36	29
Pyrene	UG/L	50	54	25	24.4 J	10 U	10 U
Total Carcinogenic PAHs	UG/L	-	95	33	51.58	ND	ND
Total Non-Carcinogenic PAHs	UG/L	-	5,658	5,392	1,322.35	1,827	1,828
Total Polynuclear Aromatic Hydrocarbons	UG/L	-	5,753	5,425	1,373.93	1,827	1,828
Total Semivolatile Organic Compounds	UG/L	-	6,074	5,735	1,373.93	2,001	1,995
Metals							
Aluminum	UG/L	-	10,600	16,800	6,650	25,600	30,400
Antimony	UG/L	3	5 U	5 U	2 U	1.2 J	1 U
Arsenic	UG/L	25	46	14.2	6	19	21.3
Barium	UG/L	1000	544	584	150	857	856
Cadmium	UG/L	5	0.4 U	0.4 U	5 U	29	28

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

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Only Detected Results Reported.

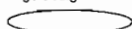
Detection Limits shown are MDL

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-04	MW-04	MW-04	MW-05	MW-05
Sample ID			MW-9204	MW-9204DUP	ACGD3H9204	MW-05	MW-05DUP
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			09/21/93	09/21/93	10/31/96	12/01/92	12/01/92
Parameter	Units	Criteria*	Field Duplicate (1-1)				Field Duplicate (1-1)
Metals							
Chromium	UG/L	50	26	35	13	57	64
Copper	UG/L	200	63	82	32	86	95
Iron	UG/L	300	26,300	32,900	NA	62,200	66,800
Lead	UG/L	25	26.1	31.7	40	27.3	29.7
Manganese	UG/L	300	1,130	1,230	NA	3,700	3,790
Mercury	UG/L	0.7	0.1 U	0.1 U	0.2 U	0.2 J	0.19 J
Nickel	UG/L	100	23 J	41	20 U	90	96
Selenium	UG/L	10	1.7 U	1.7 U	9 U	2 U	2 U
Silver	UG/L	50	7 U	7 U	10 U	5 U	5 U
Vanadium	UG/L	-	16 J	35 J	10 U	38 J	50
Zinc	UG/L	2000	86	101	92	132	158
Miscellaneous Parameters							
Cyanide	MGL	-	0.0787	0.0754	0.03	0.0727	0.0487
Cyanide, Amenable To Chlorination	MGL	-	0.0787	0.0636	0.02 U	0.01 U	0.01 U
pH	S.U.	-	NA	NA	7.5	NA	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

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U - Not detected above the reported quantitation limit.

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Only Detected Results Reported.

Detection Limits shown are MDL

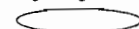
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 [MATRIX] = 'WG'

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-05	MW-05	MW-05	MW-05
Sample ID			MW-05	MW-05	MW-9205	ACGDSH9205
Matrix			Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-
Date Sampled			03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*				
Volatile Organic Compounds						
Acetone	UG/L	50	NA	NA	NA	NA
Benzene	UG/L	1	4,000	3,100	6,000	4,040
Ethylbenzene	UG/L	5	1,900	1,700	2,200	2,060
m&p-Xylene	UG/L	5	NA	150	150	NA
Methylene chloride	UG/L	5	NA	50 B	NA	NA
o-Xylene	UG/L	5	NA	160	230	NA
Toluene	UG/L	5	29	50 U	50	20 U
Xylene (total)	UG/L	5	500	NA	NA	361
Total Volatile Organic Compounds	UG/L	-	6,429	5,160	8,630	6,461
Semivolatile Organic Compounds						
2,4-Dimethylphenol	UG/L	50	10 U	10 U	10 U	NA
2-Methylnaphthalene	UG/L	-	200	110	13	NA
4-Methylphenol (p-cresol)	UG/L	1	10 U	10 U	10 U	NA
Acenaphthene	UG/L	20	210	200	220	63.1 J
Acenaphthylene	UG/L	50	3 J	3 J	2 J	2 UJ
Anthracene	UG/L	50	3 J	3 J	4 J	2 UJ
Benzo(a)anthracene	UG/L	0.002	10 U	10 U	10 U	2 UJ
Benzo(a)pyrene	UG/L	ND	10 U	10 U	10 U	2 UJ
Benzo(b)fluoranthene	UG/L	0.002	10 U	10 U	10 U	2 UJ
Benzo(g,h,i)perylene	UG/L	50	10 U	10 U	10 U	2 UJ
Benzo(k)fluoranthene	UG/L	0.002	10 U	10 U	10 U	2 UJ
bis(2-Ethylhexyl)phthalate	UG/L	5	10 U	10 U	10 U	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-05	MW-05	MW-05	MW-05
Sample ID			MW-05	MW-05	MW-0205	ACGDSH9205
Matrix			Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-
Date Sampled			03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*				
Semivolatile Organic Compounds						
Carbazole	UG/L	50	NA	NA	11	NA
Chrysene	UG/L	0.002	10 U	10 U	10 U	2 UJ
Dibenz(a,h)anthracene	UG/L	50	10 U	10 U	10 U	2 UJ
Dibenzofuran	UG/L	50	5 J	6 J	7 J	NA
Fluoranthene	UG/L	50	10 U	10 U	10 U	2 UJ
Fluorene	UG/L	50	37	43	43	10.9 J
Indeno(1,2,3-cd)pyrene	UG/L	0.002	10 U	10 U	10 U	2 UJ
Naphthalene	UG/L	10	6,700	3,800 D	5,400 D	1,620 J
Nitrobenzene	UG/L	0.4	NA	10 U	10 U	NA
Phenanthrene	UG/L	50	30	32	38	7.14 J
Phenol	UG/L	1	33	42	36	NA
Pyrene	UG/L	50	10 U	10 U	10 U	2 UJ
Total Carcinogenic PAHs	UG/L	-	ND	ND	ND	ND
Total Non-Carcinogenic PAHs	UG/L	-	6,983	4,081	5,707	1,701.14
Total Polynuclear Aromatic Hydrocarbons	UG/L	-	6,983	4,081	5,707	1,701.14
Total Semivolatile Organic Compounds	UG/L	-	7,221	4,239	5,774	1,701.14
Metals						
Aluminum	UG/L	-	21,100	8,620	11,000	320
Antimony	UG/L	3	3 U	3 U	5 U	2 U
Arsenic	UG/L	25	23.1	11.6	19.7	9
Barium	UG/L	1000	731	699	766	500
Cadmium	UG/L	5	4 U	0.4 U	0.4 U	5 U

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

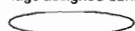
Detection Limits shown are MDL

TABLE 1
SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			MW-05	MW-05	MW-05	MW-05
Sample ID			MW-05	MW-05	MW-9205	ACGDSH9205
Matrix			Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-
Date Sampled			03/18/93	06/04/93	09/21/93	10/31/96
Parameter	Units	Criteria*				
Metals						
Chromium	UG/L	50	47	12	22	10 U
Copper	UG/L	200	74	25	41	10 U
Iron	UG/L	300	53,900	24,700	33,300	NA
Lead	UG/L	25	26.5	8.2	21	3
Manganese	UG/L	300	3,280	1,640	1,990	NA
Mercury	UG/L	0.7	0.1 U	0.1 U	0.1 U	0.2 U
Nickel	UG/L	100	72	21 J	28 J	20 U
Selenium	UG/L	10	2 U	2 U	1.7 U	9 U
Silver	UG/L	50	6 U	6 U	7 U	10 U
Vanadium	UG/L	-	42	24 J	12 J	10 U
Zinc	UG/L	2000	111	39	73	11
Miscellaneous Parameters						
Cyanide	MG/L	-	0.0568	0.0534	0.0787	0.04
Cyanide, Amenable To Chlorination	MG/L	-	1.2 U	0.01 U	0.0787	0.03
pH	S.U.	-	NA	NA	NA	7.5

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, April 2000, Class GA.

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			CGAC-SS1	CGAC-SS2	CGAC-SS3	CGAC-SS4	CGAC-SS5
Sample ID			CGAC-SS1	CGAC-SS2	CGAC-SS3	CGAC-SS4	CGAC-SS5
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			-	-	-	-	-
Date Sampled			11/27/90	11/27/90	11/27/90	11/27/90	11/27/90
Parameter	Units	Criteria*					
Volatile Organic Compounds							
Acetone	MG/KG	0.2	0.096 U	0.078 U	0.078 U	6.8 U	7.6 U
Carbon tetrachloride	MG/KG	0.6	0.0096 U	0.0078 U	0.0078 U	0.68 U	0.76 U
Methylene chloride	MG/KG	0.1	0.019 U	0.015 U	0.015 U	1.4 U	1.5 U
Toluene	MG/KG	1.5	0.0096 U	0.0078 U	0.0078 U	0.57 J	0.7 J
Total Volatile Organic Compounds	MG/KG	-	ND	ND	ND	0.57	0.7
Semivolatile Organic Compounds							
2-Methylnaphthalene	MG/KG	36.4	1 U	0.41 J	0.5 J	1.4 U	0.82 U
Acenaphthene	MG/KG	50	1 U	2.6 J	3.9 J	1.4 U	0.82 U
Acenaphthylene	MG/KG	41	1 U	1.5 J	0.63 J	1.4 U	0.82 U
Anthracene	MG/KG	50	1 U	6.9	12	1.4 U	0.3 J
Benzo(a)anthracene	MG/KG	0.224 or MDL	1 U	23	30	1.4 U	1.2
Benzo(a)pyrene	MG/KG	0.061 or MDL	0.25 J	20 U	4.1	1.8	1.1 J
Benzo(b)fluoranthene	MG/KG	1.1	0.45 J	3.5 J	29	2.5	1.7
Benzo(g,h,i)perylene	MG/KG	50	1 U	4.1 U	4.1 U	1.4 U	0.82 U
Benzo(k)fluoranthene	MG/KG	1.1	0.19 J	45	13	1.4 U	0.6 J
bis(2-Ethylhexyl)phthalate	MG/KG	50	1 U	4.1 U	4.1 U	1.4 U	0.23 J
Chrysene	MG/KG	0.4	0.38 J	24	28	2.4	1.3
Dibenz(a,h)anthracene	MG/KG	0.014 or MDL	1 U	4.1 U	4.1 U	1.4 U	0.82 U
Dibenzofuran	MG/KG	6.2	1 U	1.5 J	2.1 J	1.4 U	0.82 U
Di-n-butylphthalate	MG/KG	8.1	1 U	4.1 U	4.1 U	1.4 U	0.82 U
Fluoranthene	MG/KG	50	0.63 J	40	86	3.8	2.4
Fluorene	MG/KG	50	1 U	2.5 J	4.3	0.16 J	0.82 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

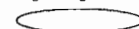
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TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			CGAC-SS1	CGAC-SS2	CGAC-SS3	CGAC-SS4	CGAC-SS5
Sample ID			CGAC-SS1	CGAC-SS2	CGAC-SS3	CGAC-SS4	CGAC-SS5
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			-	-	-	-	-
Date Sampled			11/27/90	11/27/90	11/27/90	11/27/90	11/27/90
Parameter	Units	Criteria*					
Semivolatile Organic Compounds							
Indeno(1,2,3-cd)pyrene	MG/KG	3.2	0.15 J	8.4	6.1	0.91 J	0.5 J
Naphthalene	MG/KG	13	1 U	20 J	1.5 J	1.4 U	0.086 J
Phenanthrene	MG/KG	50	NA	NA	NA	NA	NA
Pyrene	MG/KG	50	NA	NA	NA	NA	NA
Total Carcinogenic PAHs	MG/KG	-	1.42	123.9	110.2	7.61	6.4
Total Non-Carcinogenic PAHs	MG/KG	-	0.63	73.5	108.33	3.96	2.786
Total Polynuclear Aromatic Hydrocarbons	MG/KG	-	2.05	197.4	218.53	11.57	9.186
Total Semivolatile Organic Compounds	MG/KG	-	2.05	199.31	221.13	11.57	9.416
Metals							
Aluminum	MG/KG	SB	NA	NA	NA	NA	NA
Antimony	MG/KG	SB	9.3 U	7.5 U	7.5 U	13 U	7.3 U
Arsenic	MG/KG	7.5	NA	NA	NA	NA	NA
Barium	MG/KG	300	NA	NA	NA	NA	NA
Cadmium	MG/KG	1	NA	NA	NA	NA	NA
Chromium	MG/KG	10	NA	NA	NA	NA	NA
Copper	MG/KG	25	NA	NA	NA	NA	NA
Iron	MG/KG	2000	NA	NA	NA	NA	NA
Lead	MG/KG	SB	NA	NA	NA	NA	NA
Magnesium	MG/KG	SB	NA	NA	NA	NA	NA
Manganese	MG/KG	SB	NA	NA	NA	NA	NA
Nickel	MG/KG	13	NA	NA	NA	NA	NA
Selenium	MG/KG	2	3.8 U	3.1 U	3 U	2.6 U	3 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SURSOIL
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 [MATRIX] = 'SO' AND ([LOCID] LIKE 'CGAC-SS*' OR [LOCID] LIKE 'SF-')

TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			CGAC-SS1	CGAC-SS2	CGAC-SS3	CGAC-SS4	CGAC-SS5
Sample ID			CGAC-SS1	CGAC-SS2	CGAC-SS3	CGAC-SS4	CGAC-SS5
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			-	-	-	-	-
Date Sampled			11/27/90	11/27/90	11/27/90	11/27/90	11/27/90
Parameter	Units	Criteria*					
Metals							
Vanadium	MG/KG	150	15	13	14	12	11
Zinc	MG/KG	20	100	250	140	58	130
Miscellaneous Parameters							
Cyanide	MG/KG	-	0.76 U	8.7	3.2	0.52 U	0.6 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

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Only Detected Results Reported.

Detection Limits shown are MDL

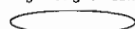
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TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			SF-01	SF-02	SF-03	SF-04	SF-05
Sample ID			SF-01	SF-02	SF-03	SF-04	SF-05
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			-	-	-	-	-
Date Sampled			09/09/92	09/09/92	09/09/92	09/09/92	09/09/92
Parameter	Units	Criteria*					Field Duplicate (1-1)
Volatile Organic Compounds							
Acetone	MG/KG	0.2	0.011 U	0.011 U	0.013 U	0.008	0.014 U
Carbon tetrachloride	MG/KG	0.6	0.003 J	0.005 U	0.006 U	0.006 U	0.005 J
Methylene chloride	MG/KG	0.1	0.006	0.005	0.014	0.008	0.009
Toluene	MG/KG	1.5	0.006 U	0.005 U	0.006 U	0.006 U	0.007 U
Total Volatile Organic Compounds	MG/KG	-	0.009	0.005	0.014	0.016	0.014
Semivolatile Organic Compounds							
2-Methylnaphthalene	MG/KG	36.4	0.75 U	0.71 U	0.11 J	39 U	0.87 U
Acenaphthene	MG/KG	50	0.75 U	0.17 J	0.21 J	39 U	0.24 J
Acenaphthylene	MG/KG	41	1,020 U	0.089 J	0.36 J	5.6 J	0.14 J
Anthracene	MG/KG	50	0.1 J	0.54 J	0.73 J	14 J	0.63 J
Benzo(a)anthracene	MG/KG	0.224 or MDL	0.58 J	2.8	4.1	98	3.7
Benzo(a)pyrene	MG/KG	0.061 or MDL	0.36 J	1.5	2.7	104	2
Benzo(b)fluoranthene	MG/KG	1.1	0.33 J	0.68	2.1	74	0.87 U
Benzo(g,h,i)perylene	MG/KG	50	0.75 U	1.8	3.2	111	2.2
Benzo(k)fluoranthene	MG/KG	1.1	0.32 J	0.71 U	0.80 U	105	0.87 U
bis(2-Ethylhexyl)phthalate	MG/KG	50	0.75 U	0.71 U	0.087 J	39 U	0.26 J
Chrysene	MG/KG	0.4	0.65 J	3	4.4	112	4
Dibenz(a,h)anthracene	MG/KG	0.014 or MDL	0.75 U	0.36 J	0.62 J	19 J	0.48 J
Dibenzofuran	MG/KG	6.2	0.75 U	0.71 U	0.80 U	39 U	0.87 U
Di-n-butylphthalate	MG/KG	8.1	0.75 U	0.12 J	0.11 J	39 U	0.1
Fluoranthene	MG/KG	50	1.1	5.4	7.4	276	6.8
Fluorene	MG/KG	50	0.75 U	0.2 J	0.38 J	7.5 J	0.34 J

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SURSQL
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 (MATRIX) = 'SO' AND ((LOCID) LIKE 'CGAC-SS' OR (LOCID) LIKE 'SF-')

TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			SF-01	SF-02	SF-03	SF-04	SF-05
Sample ID			SF-01	SF-02	SF-03	SF-04	SF-05
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			-	-	-	-	-
Date Sampled			09/09/92	09/09/92	09/09/92	09/09/92	09/09/92
Parameter	Units	Criteria*					Field Duplicate (1-1)
Semivolatile Organic Compounds							
Indeno(1,2,3-cd)pyrene	MG/KG	3.2	0.13 J	1.3	2.3	82	1.7
Naphthalene	MG/KG	13	0.75 U	0.71 U	0.24 J	39 U	0.1 J
Phenanthrene	MG/KG	50	0.52 J	3	5	171	4.4
Pyrene	MG/KG	50	1	6.6	11	349	8.9
Total Carcinogenic PAHs	MG/KG	-	2.37	9.64	16.22	594	11.88
Total Non-Carcinogenic PAHs	MG/KG	-	2.72	17.799	28.52	934.1	23.75
Total Polynuclear Aromatic Hydrocarbons	MG/KG	-	5.09	27.439	44.74	1,528.1	35.63
Total Semivolatile Organic Compounds	MG/KG	-	5.09	27.559	45.047	1,528.1	35.99
Metals							
Aluminum	MG/KG	SB	3,110	3,610	4,200	4,930	2,450
Antimony	MG/KG	SB	0.11 U	0.11 U	0.21 J	0.65 J	0.71 J
Arsenic	MG/KG	7.5	3.3	6.4	2.1 J	3.6	4.5
Barium	MG/KG	300	32.7	38.3	51.9	185	68.8
Cadmium	MG/KG	1	0.33 J	0.41 J	0.5 J	2	1.1
Chromium	MG/KG	10	7.2	7.4	9.5	14.2	9
Copper	MG/KG	25	41.8	27.8	32.2	43.8	55.8
Iron	MG/KG	2000	8,700	10,000	9,030	19,800	9,990
Lead	MG/KG	SB	264	28.9	4.2	508	134
Magnesium	MG/KG	SB	13,800	20,100	14,100	15,900	6,320
Manganese	MG/KG	SB	318	338	259	348	162
Nickel	MG/KG	13	9.5	13.1	12.3	17.1	14.5
Selenium	MG/KG	2	0.23 U	2 U	0.25 U	2.3 U	0.74

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SURSOIL

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Printed: 10/14/04 11:30:40 AM

[MATRIX] = 'SO' AND ([LOCID] LIKE 'CGAC-SS' OR [LOCID] LIKE 'SF-')

TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			SF-01	SF-02	SF-03	SF-04	SF-05
Sample ID			SF-01	SF-02	SF-03	SF-04	SF-05
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			-	-	-	-	-
Date Sampled			09/09/92	09/09/92	09/09/92	09/09/92	09/09/92
Parameter	Units	Criteria*					Field Duplicate (1-1)
Metals							
Vanadium	MG/KG	150	7.7	9.8	13.8	24.9	9.3
Zinc	MG/KG	20	67.4	37.8	80.9	353	144
Miscellaneous Parameters							
Cyanide	MG/KG	-	1.2 U	1.1 U	1.2 U	1.2 U	1.3 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

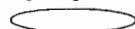
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Printed: 10/14/04 11:30:40 AM
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TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			SF-05
Sample ID			SF-05
Matrix			Soil
Depth Interval (ft)			-
Date Sampled			09/09/92
Parameter	Units	Criteria*	
Volatile Organic Compounds			
Acetone	MG/KG	0.2	0.013 U
Carbon tetrachloride	MG/KG	0.6	0.007
Methylene chloride	MG/KG	0.1	0.013 U
Toluene	MG/KG	1.5	0.007 U
Total Volatile Organic Compounds	MG/KG	-	0.007
Semivolatile Organic Compounds			
2-Methylnaphthalene	MG/KG	36.4	0.82 U
Acenaphthene	MG/KG	50	0.4 J
Acenaphthylene	MG/KG	41	0.82 U
Anthracene	MG/KG	50	0.77 J
Benzo(a)anthracene	MG/KG	0.224 or MDL	3.7
Benzo(a)pyrene	MG/KG	0.061 or MDL	2.3
Benzo(b)fluoranthene	MG/KG	1.1	1.5
Benzo(g,h,i)perylene	MG/KG	50	2.1
Benzo(k)fluoranthene	MG/KG	1.1	0.82 U
bis(2-Ethylhexyl)phthalate	MG/KG	50	0.2 J
Chrysene	MG/KG	0.4	3.8
Dibenz(a,h)anthracene	MG/KG	0.014 or MDL	0.49 J
Dibenzofuran	MG/KG	6.2	0.13 J
Di-n-butylphthalate	MG/KG	8.1	0.11 J
Fluoranthene	MG/KG	50	6.6
Fluorene	MG/KG	50	0.32 J

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			SF-05
Sample ID			SF-05
Matrix			Soil
Depth Interval (ft)			-
Date Sampled			09/09/92
Parameter	Units	Criteria*	
Semivolatile Organic Compounds			
Indeno(1,2,3-cd)pyrene	MG/KG	3.2	1.7
Naphthalene	MG/KG	13	0.21 J
Phenanthrene	MG/KG	50	3.6
Pyrene	MG/KG	50	6.2
Total Carcinogenic PAHs	MG/KG	-	13.49
Total Non-Carcinogenic PAHs	MG/KG	-	20.2
Total Polynuclear Aromatic Hydrocarbons	MG/KG	-	33.69
Total Semivolatile Organic Compounds	MG/KG	-	34.13
Metals			
Aluminum	MG/KG	SB	2,130
Antimony	MG/KG	SB	0.78 J
Arsenic	MG/KG	7.5	6.1
Barium	MG/KG	300	66
Cadmium	MG/KG	1	0.86
Chromium	MG/KG	10	8.1
Copper	MG/KG	25	55.5
Iron	MG/KG	2000	8,750
Lead	MG/KG	SB	118
Magnesium	MG/KG	SB	5,860
Manganese	MG/KG	SB	168
Nickel	MG/KG	13	15.5
Selenium	MG/KG	2	0.61

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

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U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SURSOIL
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[MATRIX] = 'SO' AND ([LOCID] LIKE 'CGAC-SS' OR [LOCID] LIKE 'SF-')

TABLE 2
SUMMARY OF HISTORICAL SURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			SF-05
Sample ID			SF-05
Matrix			Soil
Depth Interval (ft)			-
Date Sampled			09/09/92
Parameter	Units	Criteria*	
Metals			
Vanadium	MG/KG	150	9.4
Zinc	MG/KG	20	141
Miscellaneous Parameters			
Cyanide	MG/KG	-	1.3 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SURSOIL
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Printed: 10/14/04 11:30:40 AM
[MATRIX] = 'SO' AND ([LOCID] LIKE 'CGAC-SS' OR [LOCID] LIKE 'SF-')

TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TB-03	TB-06	TB-06	TB-10	TB-10
Sample ID			TB-03	TB-06	TB-06	TB-10	TB-10
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			6.0-8.0	8.0-10.0	10.0-12.0	8.0-10.0	10.0-12.0
Date Sampled			08/18/92	08/19/92	08/19/92	08/20/92	08/20/92
Parameter	Units	Criteria*					
Volatile Organic Compounds							
Acetone	MG/KG	0.2	7.9 U	4.9 J	0.027	6.3 U	1.4 U
Benzene	MG/KG	0.06	6.8	3.1 U	0.007 U	3.1 U	0.7 U
Ethylbenzene	MG/KG	5.5	55	5.8	0.007 U	29	1.3
Methyl ethyl ketone (2-Butanone)	MG/KG	0.3	7.9 U	6.2 U	0.013 U	6.3 U	1.4 U
Methylene chloride	MG/KG	0.1	3.9	17	0.02	3.4	2.4
Styrene	MG/KG	-	4 U	3.1 U	0.007 U	3.1 U	0.7 U
Tetrachloroethene	MG/KG	1.4	4	3.1 U	0.007 U	3.1 U	0.7 U
Toluene	MG/KG	1.5	4	3.1 U	0.007 U	3.1 U	0.7 U
Xylene (total)	MG/KG	1.2	70	3.1 U	0.007 U	69	0.7 U
Total Volatile Organic Compounds	MG/KG	-	143.7	27.7	0.047	101.4	3.7
Semivolatile Organic Compounds							
2-Methylnaphthalene	MG/KG	36.4	56 D	10 D	0.71 U	83 D	26 D
4-Nitrophenol	MG/KG	0.1 or MDL	41 U	20 U	3.5 U	81 U	37 U
Acenaphthene	MG/KG	50	46 D	15 D	0.34 J	64 D	20 D
Acenaphthylene	MG/KG	41	3.7 D	4.1 U	0.71 U	16 U	7.5 U
Anthracene	MG/KG	50	26 D	2.4 D	0.095 J	29 D	7.6 D
Benzo(a)anthracene	MG/KG	0.224 or MDL	16 D	1.3 JD	0.71 U	18 D	4.8 JD
Benzo(a)pyrene	MG/KG	0.061 or MDL	12 D	0.43 JD	0.71 U	12 JD	3 JD
Benzo(b)fluoranthene	MG/KG	1.1	5 JD	4.1 U	0.71 U	4.7 JD	1.4 JD
Benzo(g,h,i)perylene	MG/KG	50	5 JD	4.1 U	0.71 U	16 U	7.5 U
Benzo(k)fluoranthene	MG/KG	1.1	7.9 JD	4.1 U	0.71 U	7.2 JD	1.5 JD
bis(2-Ethylhexyl)phthalate	MG/KG	50	4.6 JD	4.1 U	0.55 J	16 U	7.5 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

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Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SUBSOIL
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TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TB-03	TB-06	TB-06	TB-10	TB-10
Sample ID			TB-03	TB-06	TB-06	TB-10	TB-10
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			6.0-8.0	8.0-10.0	10.0-12.0	8.0-10.0	10.0-12.0
Date Sampled			08/18/92	08/19/92	08/19/92	08/20/92	08/20/92
Parameter	Units	Criteria*					
Semivolatile Organic Compounds							
Chrysene	MG/KG	0.4	15 D	1.3 JD	0.71 U	17 D	4.6 JD
Dibenz(a,h)anthracene	MG/KG	0.014 or MDL	8.2 U	4.1 U	0.71 U	16 U	7.5 U
Dibenzofuran	MG/KG	6.2	1.4 JD	0.5 JD	0.71 U	3.4 JD	0.97 JD
Di-n-butylphthalate	MG/KG	8.1	8.2 U	4.1 U	0.23 J	16 U	7.5 U
Fluoranthene	MG/KG	50	32 D	2.8 JD	0.12 J	43 D	11 D
Fluorene	MG/KG	50	19 D	4.4 D	0.15 J	39 D	11 D
Indeno(1,2,3-cd)pyrene	MG/KG	3.2	4.6 D	4.1 U	0.71 U	3.8 JD	7.5 U
Isophorone	MG/KG	4.4	8.2 U	4.1 U	0.71 U	16 U	7.5 U
Naphthalene	MG/KG	13	100 D	40 D	0.17 J	223 JD	83 D
Pentachlorophenol	MG/KG	1 or MDL	41 U	20 D	3.5 U	81 U	37 U
Phenanthrene	MG/KG	50	77 D	11 D	0.52 J	106 D	33 D
Pyrene	MG/KG	50	42 D	3.6 D	0.13 J	52 D	15 D
Total Carcinogenic PAHs	MG/KG	-	60.5	3.03	ND	62.7	15.3
Total Non-Carcinogenic PAHs	MG/KG	-	350.7	79.2	1.525	556	180.6
Total Polynuclear Aromatic Hydrocarbons	MG/KG	-	411.2	82.23	1.525	618.7	195.9
Total Semivolatile Organic Compounds	MG/KG	-	473.2	112.73	2.305	705.1	222.87
Metals							
Aluminum	MG/KG	SB	5,390	4,880	4,830	6,060	5,520
Antimony	MG/KG	SB	0.83 J	1.1 J	0.75 J	0.82 J	0.45 J
Arsenic	MG/KG	7.5	6.9	5.6	3.3	6.7	2
Barium	MG/KG	300	54.9	41.9	32.6	55.1	60
Cadmium	MG/KG	1	0.47	0.35 U	0.26 J	0.82	0.42

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

○ Concentration Exceeds Criteria

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Only Detected Results Reported.

Detection Limits shown are MDL

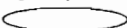
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Printed: 10/14/04 11:32 10 AM
[MATRIX] = 'SO' AND [LOCID] LIKE 'T'

TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TB-03	TB-06	TB-06	TB-10	TB-10
Sample ID			TB-03	TB-06	TB-06	TB-10	TB-10
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			6.0-8.0	8.0-10.0	10.0-12.0	8.0-10.0	10.0-12.0
Date Sampled			08/18/92	08/19/92	08/19/92	08/20/92	08/20/92
Parameter	Units	Criteria*					
Metals							
Chromium	MG/KG	10	10.4	9.1	8.8	11	8.1
Copper	MG/KG	25	23.9	22.6	35.8	27.5	21.2
Iron	MG/KG	2000	16,700	12,700	10,800	16,300	9,650
Lead	MG/KG	SB	12.9	1.2 U	0.88	5.2	0.91 U
Magnesium	MG/KG	SB	29,600	20,000	37,800	11,100	23,000
Manganese	MG/KG	SB	606	550	584	722	305
Mercury	MG/KG	0.1	0.19 J	NA	0.05 U	0.06 U	0.05 U
Nickel	MG/KG	13	17.9	17.4	10.9	22.3	11.1
Selenium	MG/KG	2	0.18 U	1.2 U	0.88 U	0.22 U	0.18 U
Silver	MG/KG	SB	0.75 J	0.58 U	0.47 U	0.45 U	0.42 U
Vanadium	MG/KG	150	13.5 J	13.7	12	16.2	8.6
Zinc	MG/KG	20	53.5	38.6	36.6	48.7	24.2
Miscellaneous Parameters							
Cyanide	MG/KG	-	1.2 U	1.2 U	1 U	1.3 U	1.1 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

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Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection SUBSOIL
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 Printed: 10/14/04 11:32:10 AM
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TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TB-12	TB-15	TP-01	TP-02	TP-04
Sample ID			TB-12	TB-15	TP-01	TP-02	TP-04
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			8.0-10.0	2.0-6.0	3.5-3.5	2.8-2.8	3.0-3.0
Date Sampled			08/20/92	08/21/92	08/13/92	08/13/92	08/14/92
Parameter	Units	Criteria*					Field Duplicate (1-1)
Volatile Organic Compounds							
Acetone	MG/KG	0.2	79 U	16 U	0.2	0.16	16
Benzene	MG/KG	0.06	25 J	13	0.008 J	0.018	5.4 J
Ethylbenzene	MG/KG	5.5	264	9.6	0.021 U	0.031	96
Methyl ethyl ketone (2-Butanone)	MG/KG	0.3	79 U	16 U	0.048	0.02 U	14 U
Methylene chloride	MG/KG	0.1	52	11	0.057	0.2	11
Styrene	MG/KG	-	40 U	7.8 U	0.021 U	0.004 J	7.2 U
Tetrachloroethene	MG/KG	1.4	40 U	7.8 U	0.021 U	0.01 U	7.2 U
Toluene	MG/KG	1.5	96	22	0.021 U	0.019	26
Xylene (total)	MG/KG	1.2	147	7.6 J	0.021 U	0.12	66
Total Volatile Organic Compounds	MG/KG	-	584	63.2	0.313	0.552	220.4
Semivolatile Organic Compounds							
2-Methylnaphthalene	MG/KG	36.4	1,240 D	507 D	0.49 J	14 J	4,040 D
4-Nitrophenol	MG/KG	0.1 or MDL	827 U	665 U	21 U	201 U	120 D
Acenaphthene	MG/KG	50	310 D	29 JD	17	65	227 JD
Acenaphthylene	MG/KG	41	1,020 U	404 D	1.9 J	26 J	3,890 D
Anthracene	MG/KG	50	683 D	189 D	14	69	1,860 D
Benzo(a)anthracene	MG/KG	0.224 or MDL	401 D	147 D	14	160	1,480 D
Benzo(a)pyrene	MG/KG	0.061 or MDL	303 D	132 JD	12	228	1,580 D
Benzo(b)fluoranthene	MG/KG	1.1	165 U	69 JD	5.6	139	800 JD
Benzo(g,h,i)perylene	MG/KG	50	158 D	25 JD	6	200	784 JD
Benzo(k)fluoranthene	MG/KG	1.1	165 U	73 JD	6.1	170	1,090 D
bis(2-Ethylhexyl)phthalate	MG/KG	50	165 U	133 U	1.1 J	40 U	940 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

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Only Detected Results Reported.

Detection Limits shown are MDL

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Printed: 10/14/04 11:32:10 AM
[MATRIX] = 'SO' AND [LOCID] LIKE '1'

TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TB-12	TB-15	TP-01	TP-02	TP-04
Sample ID			TB-12	TB-15	TP-01	TP-02	TP-04
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			8.0-10.0	2.0-6.0	3.5-3.5	2.8-2.8	3.0-3.0
Date Sampled			08/20/92	08/21/92	08/13/92	08/13/92	08/14/92
Parameter	Units	Criteria*					Field Duplicate (1-1)
Semivolatile Organic Compounds							
Chrysene	MG/KG	0.4	389 D	148 D	14	164	1,470 D
Dibenz(a,h)anthracene	MG/KG	0.014 or MDL	165 U	133 U	2.3 J	51	193 JD
Dibenzofuran	MG/KG	6.2	88 JD	23 JD	1.2 J	5 J	207 JD
Di-n-butylphthalate	MG/KG	8.1	165 U	133 U	4.1 U	40 U	940 U
Fluoranthene	MG/KG	50	1,330 D	380 D	25	297	3,650 D
Fluorene	MG/KG	50	788 D	201 D	14	56	1,810 D
Indeno(1,2,3-cd)pyrene	MG/KG	3.2	114 JD	45 JD	5	154	607 D
Isophorone	MG/KG	4.4	165 U	133 U	4.1 U	40 U	178 JD
Naphthalene	MG/KG	13	3,060 D	2,100 D	1.2 J	32 J	16,300 D
Pentachlorophenol	MG/KG	1 or MDL	827 U	665 U	21 U	201 U	4,700 U
Phenanthrene	MG/KG	50	2,490 D	784 D	42	233	7,110 D
Pyrene	MG/KG	50	1,600 D	484 D	32	396	4,440 D
Total Carcinogenic PAHs	MG/KG	-	1,207	614	59	1,066	7,220
Total Non-Carcinogenic PAHs	MG/KG	-	10,419	4,596	153.1	1,374	40,071
Total Polynuclear Aromatic Hydrocarbons	MG/KG	-	11,626	5,210	212.1	2,440	47,291
Total Semivolatile Organic Compounds	MG/KG	-	12,954	5,740	214.89	2,459	51,836
Metals							
Aluminum	MG/KG	SB	6,020	7,830	3,890	4,380	601
Antimony	MG/KG	SB	1.1 J	0.82 J	0.58 J	1.4 J	1.6 J
Arsenic	MG/KG	7.5	5	6.8	4.1	11.6	48.4
Barium	MG/KG	300	35.2	83.3	46.9	108	23.9
Cadmium	MG/KG	1	0.3 U	0.53	0.33 J	2.9	0.7

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

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Only Detected Results Reported.

Detection Limits shown are MDL

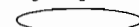
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TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TB-12	TB-15	TP-01	TP-02	TP-04
Sample ID			TB-12	TB-15	TP-01	TP-02	TP-04
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			8.0-10.0	2.0-6.0	3.5-3.5	2.8-2.8	3.0-3.0
Date Sampled			08/20/92	08/21/92	08/13/92	08/13/92	08/14/92
Parameter	Units	Criteria*					Field Duplicate (1-1)
Metals							
Chromium	MG/KG	10	11.7	13.8	7.1	11.6	2.6
Copper	MG/KG	25	34.6	23.6	16.4	98.4	27.5
Iron	MG/KG	2000	14,500	17,300	9,820	16,300	8,590
Lead	MG/KG	SB	3.6 J	13.5	64.9	350	236
Magnesium	MG/KG	SB	34,500	9,550	4,950	10,700	3,990
Manganese	MG/KG	SB	506	571	527	575	63.9
Mercury	MG/KG	0.1	0.05 U	0.09 J	NA	NA	NA
Nickel	MG/KG	13	25.1	16.6	8.1	12.2	3.3 J
Selenium	MG/KG	2	0.23 U	0.22	0.42 J	1	2.6 J
Silver	MG/KG	SB	0.81 J	0.53 U	0.54 U	0.56 J	1.1 J
Vanadium	MG/KG	150	14.5	18	9.5	16.8	1.8 J
Zinc	MG/KG	20	47	49.1	47.5	325	137
Miscellaneous Parameters							
Cyanide	MG/KG	-	2	13	4.5	2.5	16

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

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J - The reported concentration is an estimated value.

D - Result reported from a secondary dilution analysis.

Only Detected Results Reported.

Detection Limits shown are MDL

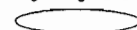
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TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TP-04	TP-04	TP-04	TP-05	TP-05
Sample ID			TP-04	TP-04	TP-04	TP-05	TP-05
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			3.0-3.0	3.0-3.0	3.0-3.0	3.0-3.0	3.0-3.0
Date Sampled			08/14/92	08/14/92	08/14/92	08/14/92	08/14/92
Parameter	Units	Criteria*	Field Duplicate (1-1)				
Volatile Organic Compounds							
Acetone	MG/KG	0.2	14 U	16	14 U	13 U	13 U
Benzene	MG/KG	0.06	15	5.4 J	15	6.4 U	6.4 U
Ethylbenzene	MG/KG	5.5	260	96	260	42	42
Methyl ethyl ketone (2-Butanone)	MG/KG	0.3	14 U	14 U	14 U	13 U	13 U
Methylene chloride	MG/KG	0.1	11	11	11	17	17
Styrene	MG/KG	-	7.1 U	7.2 U	7.1 U	6.4 U	6.4 U
Tetrachloroethene	MG/KG	1.4	7.1 U	7.2 U	7.1 U	6.4 U	6.4 U
Toluene	MG/KG	1.5	87	26	87	4.6 J	4.6 J
Xylene (total)	MG/KG	1.2	166	66	166	28	28
Total Volatile Organic Compounds	MG/KG	-	539	220.4	539	91.6	91.6
Semivolatile Organic Compounds							
2-Methylnaphthalene	MG/KG	36.4	4,070 D	4,040 D	4,070 D	3,110 D	3,110 D
4-Nitrophenol	MG/KG	0.1 or MDL	4,820 U	120 D	4,820 U	3,830 U	3,830 U
Acenaphthene	MG/KG	50	231 J	227 JD	231 J	167 JD	167 JD
Acenaphthylene	MG/KG	41	4,040 D	3,890 D	4,040 D	2,880 D	2,880 D
Anthracene	MG/KG	50	1,800 D	1,860 D	1,800 D	1,370 D	1,370 D
Benzo(a)anthracene	MG/KG	0.224 or MDL	1,540 D	1,480 D	1,540 D	985 D	985 D
Benzo(a)pyrene	MG/KG	0.061 or MDL	1,630 D	1,580 D	1,630 D	1,430 D	1,430 D
Benzo(b)fluoranthene	MG/KG	1.1	893 JD	800 JD	893 JD	563 JD	563 JD
Benzo(g,h,i)perylene	MG/KG	50	807 JD	784 JD	807 JD	840 D	840 D
Benzo(k)fluoranthene	MG/KG	1.1	1,170 D	1,090 D	1,170 D	906 D	906 D
bis(2-Ethylhexyl)phthalate	MG/KG	50	965 U	940 U	965 U	767 U	767 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

D - Result reported from a secondary dilution analysis.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TP-04	TP-04	TP-04	TP-05	TP-05
Sample ID			TP-04	TP-04	TP-04	TP-05	TP-05
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			3.0-3.0	3.0-3.0	3.0-3.0	3.0-3.0	3.0-3.0
Date Sampled			08/14/92	08/14/92	08/14/92	08/14/92	08/14/92
Parameter	Units	Criteria*		Field Duplicate (1-1)			
Semivolatile Organic Compounds							
Chrysene	MG/KG	0.4	1,580 D	1,470 D	1,580 D	994 D	994 D
Dibenz(a,h)anthracene	MG/KG	0.014 or MDL	193 J	193 JD	193 J	180 JD	180 JD
Dibenzofuran	MG/KG	6.2	211 JD	207 JD	211 JD	154 JD	154 JD
Di-n-butylphthalate	MG/KG	8.1	965 U	940 U	965 U	767 U	767 U
Fluoranthene	MG/KG	50	3,660 D	3,650 D	3,660 D	2,520 D	2,520 D
Fluorene	MG/KG	50	1,880 D	1,810 D	1,880 D	1,350 D	1,350 D
Indeno(1,2,3-cd)pyrene	MG/KG	3.2	638 D	607 D	638 D	606 JD	606 JD
Isophorone	MG/KG	4.4	965 U	178 JD	965 U	767 U	767 U
Naphthalene	MG/KG	13	15,700 D	16,300 D	15,700 D	13,700 D	13,700 D
Pentachlorophenol	MG/KG	1 or MDL	4,820 U	4,700 U	4,820 U	3,830 U	3,830 U
Phenanthrene	MG/KG	50	7,290 D	7,110 D	7,290 D	5,110 D	5,110 D
Pyrene	MG/KG	50	4,860 D	4,440 D	4,860 D	3,140 D	3,140 D
Total Carcinogenic PAHs	MG/KG	-	7,644	7,220	7,644	5,664	5,664
Total Non-Carcinogenic PAHs	MG/KG	-	40,268	40,071	40,268	31,077	31,077
Total Polynuclear Aromatic Hydrocarbons	MG/KG	-	47,912	47,291	47,912	36,741	36,741
Total Semivolatile Organic Compounds	MG/KG	-	52,193	51,836	52,193	40,005	40,005
Metals							
Aluminum	MG/KG	SB	1,330	601	1,330	2,060	2,060
Antimony	MG/KG	SB	1.4 J	1.6 J	1.4 J	0.97 J	0.97 J
Arsenic	MG/KG	7.5	14.3	48.4	14.3	21.2	21.2
Barium	MG/KG	300	35.5	23.9	35.5	35.7	35.7
Cadmium	MG/KG	1	0.59	0.7	0.59	0.49	0.49

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value.

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Only Detected Results Reported.

Detection Limits shown are MDL

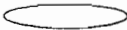
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TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TP-04	TP-04	TP-04	TP-05	TP-05
Sample ID			TP-04	TP-04	TP-04	TP-05	TP-05
Matrix			Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)			3.0-3.0	3.0-3.0	3.0-3.0	3.0-3.0	3.0-3.0
Date Sampled			08/14/92	08/14/92	08/14/92	08/14/92	08/14/92
Parameter	Units	Criteria*	Field Duplicate (1-1)				
Metals							
Chromium	MG/KG	10	3.1	2.6	3.1	4.1	4.1
Copper	MG/KG	25	27	27.5	27	37.2	37.2
Iron	MG/KG	2000	10,000	8,590	10,000	11,900	11,900
Lead	MG/KG	SB	56.7	236	56.7	87	87
Magnesium	MG/KG	SB	9,760	3,990	9,760	12,200	12,200
Manganese	MG/KG	SB	114	63.9	114	193	193
Mercury	MG/KG	0.1	NA	NA	NA	NA	NA
Nickel	MG/KG	13	5.2	3.3 J	5.2	8.3	8.3
Selenium	MG/KG	2	0.48	2.6 J	0.48	0.9	0.9
Silver	MG/KG	SB	0.88 J	1.1 J	0.88 J	0.49 J	0.49 J
Vanadium	MG/KG	150	3 J	1.8 J	3 J	5	5
Zinc	MG/KG	20	105	137	105	61.7	61.7
Miscellaneous Parameters							
Cyanide	MG/KG	-	17.1	16	17.1	6.1	6.1

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

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Only Detected Results Reported.

Detection Limits shown are MDL

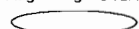
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TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TP-09	TP-09
Sample ID			TP-09	TP-09
Matrix			Soil	Soil
Depth Interval (ft)			3.0-3.0	3.0-3.0
Date Sampled			08/26/92	08/26/92
Parameter	Units	Criteria*		
Volatile Organic Compounds				
Acetone	MG/KG	0.2	0.012 U	0.012 U
Benzene	MG/KG	0.06	0.006 U	0.006 U
Ethylbenzene	MG/KG	5.5	0.006 U	0.006 U
Methyl ethyl ketone (2-Butanone)	MG/KG	0.3	0.012 U	0.012 U
Methylene chloride	MG/KG	0.1	0.023	0.023
Styrene	MG/KG	-	0.006 U	0.006 U
Tetrachloroethene	MG/KG	1.4	0.006 U	0.006 U
Toluene	MG/KG	1.5	0.006 U	0.006 U
Xylene (total)	MG/KG	1.2	0.006 U	0.006 U
Total Volatile Organic Compounds	MG/KG	-	0.023	0.023
Semivolatile Organic Compounds				
2-Methylnaphthalene	MG/KG	36.4	0.94 U	0.94 U
4-Nitrophenol	MG/KG	0.1 or MDL	3.9 U	3.9 U
Acenaphthene	MG/KG	50	0.13 J	0.13 J
Acenaphthylene	MG/KG	41	0.77 U	0.77 U
Anthracene	MG/KG	50	0.2 J	0.2 J
Benzo(a)anthracene	MG/KG	0.224 or MDL	0.75 J	0.75 J
Benzo(a)pyrene	MG/KG	0.061 or MDL	0.51 J	0.51 J
Benzo(b)fluoranthene	MG/KG	1.1	0.52 J	0.52 J
Benzo(g,h,i)perylene	MG/KG	50	0.77 U	0.77 U
Benzo(k)fluoranthene	MG/KG	1.1	0.39 J	0.39 J
bis(2-Ethylhexyl)phthalate	MG/KG	50	0.4 J	0.4 J

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

 Concentration Exceeds Criteria

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D - Result reported from a secondary dilution analysis.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TP-09	TP-09
Sample ID			TP-09	TP-09
Matrix			Soil	Soil
Depth Interval (ft)			3.0-3.0	3.0-3.0
Date Sampled			08/26/92	08/26/92
Parameter	Units	Criteria*		
Semivolatile Organic Compounds				
Chrysene	MG/KG	0.4	0.89	0.89
Dibenz(a,h)anthracene	MG/KG	0.014 or MDL	0.77 U	0.77 U
Dibenzofuran	MG/KG	6.2	0.77 U	0.77 U
Di-n-butylphthalate	MG/KG	8.1	0.77 U	0.77 U
Fluoranthene	MG/KG	50	1.8	1.8
Fluorene	MG/KG	50	0.12 J	0.12 J
Indeno(1,2,3-cd)pyrene	MG/KG	3.2	0.34 J	0.34 J
Isophorone	MG/KG	4.4	0.77 U	0.77 U
Naphthalene	MG/KG	13	0.77 U	0.77 U
Pentachlorophenol	MG/KG	1 or MDL	3.9 U	3.9 U
Phenanthrene	MG/KG	50	1.6	1.6
Pyrene	MG/KG	50	1.9	1.9
Total Carcinogenic PAHs	MG/KG	-	3.4	3.4
Total Non-Carcinogenic PAHs	MG/KG	-	5.75	5.75
Total Polynuclear Aromatic Hydrocarbons	MG/KG	-	9.15	9.15
Total Semivolatile Organic Compounds	MG/KG	-	9.55	9.55
Metals				
Aluminum	MG/KG	SB	7,660	7,660
Antimony	MG/KG	SB	1.4 J	1.4 J
Arsenic	MG/KG	7.5	12.3	12.3
Barium	MG/KG	300	83.1	83.1
Cadmium	MG/KG	1	0.93	0.93

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

○ Concentration Exceeds Criteria

NA - Not Analyzed, ND - Not Detected

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Only Detected Results Reported.

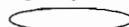
Detection Limits shown are MDL

TABLE 3
SUMMARY OF HISTORICAL SUBSURFACE SOIL ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID			TP-09	TP-09
Sample ID			TP-09	TP-09
Matrix			Soil	Soil
Depth Interval (ft)			3.0-3.0	3.0-3.0
Date Sampled			08/26/92	08/26/92
Parameter	Units	Criteria*		
Metals				
Chromium	MG/KG	10	10.2	10.2
Copper	MG/KG	25	102	102
Iron	MG/KG	2000	16,300	16,300
Lead	MG/KG	SB	54.2	54.2
Magnesium	MG/KG	SB	11,200	11,200
Manganese	MG/KG	SB	457	457
Mercury	MG/KG	0.1	NA	NA
Nickel	MG/KG	13	15.5	15.5
Selenium	MG/KG	2	0.41 J	0.41 J
Silver	MG/KG	SB	0.52 U	0.52 U
Vanadium	MG/KG	150	18.3	18.3
Zinc	MG/KG	20	81.4	81.4
Miscellaneous Parameters				
Cyanide	MG/KG	-	1.2 U	1.2 U

*Criteria- NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels; HWR-94-4046 January 24, 1994 (Revised).

Flags assigned during chemistry validation are shown.

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D - Result reported from a secondary dilution analysis.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 4
SUMMARY OF HISTORICAL SURFACE WATER ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		CGAC-SW1	CGAC-SW2	CGAC-SW3
Sample ID		CGAC-SW1	CGAC-SW2	CGAC-SW3
Matrix		Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-
Date Sampled		11/27/90	11/27/90	11/27/90
Parameter	Units			
Metals				
Zinc	UG/L	94	20 U	94

Flags assigned during chemistry validation are shown.

U - Not detected above the reported quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		CGAC-SE1	CGAC-SE2	CGAC-SE3	SS-01	SS-02
Sample ID		CGAC-SE1	CGAC-SE2	CGAC-SE3	SS-01	SS-02
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date Sampled		11/27/90	11/27/90	11/27/90	09/09/92	09/09/92
Parameter	Units					
Volatile Organic Compounds						
Acetone	MG/KG	0.11 U	8.7 U	0.082 U	0.014	0.035
Benzene	MG/KG	0.011 U	1	0.0082 U	0.006 U	0.008 U
Carbon disulfide	MG/KG	0.011 U	0.87 U	0.0082 U	0.006 U	0.008 U
Ethylbenzene	MG/KG	0.011 U	1.4	0.0082 U	0.006 U	0.008 U
Methylene chloride	MG/KG	0.022 U	1.7 U	0.016 U	0.006 JB	0.016 U
Toluene	MG/KG	0.011 U	0.87 U	0.0082 U	0.006 U	0.008 U
Xylene (total)	MG/KG	0.011 U	1.1	0.0082 U	0.006 U	0.008 U
Total Volatile Organic Compounds	MG/KG	ND	3.5	ND	0.02	0.035
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	MG/KG	NA	NA	NA	0.87 U	1.1 U
1,4-Dichlorobenzene	MG/KG	1.2 U	4.6 U	0.88 U	0.87 U	0.13 J
2,4-Dinitrotoluene	MG/KG	1.2 U	4.6 U	0.88 U	0.87 U	1.1 U
2-Chlorophenol	MG/KG	NA	NA	NA	0.87 U	1.1 U
2-Methylnaphthalene	MG/KG	1.2 U	4.6 U	0.88 U	0.043 J	1.1 U
2-Methylphenol (o-cresol)	MG/KG	NA	NA	NA	0.87 U	1.1 U
4-Chloro-3-methylphenol	MG/KG	NA	NA	NA	0.87 U	1.1 U
4-Methylphenol (p-cresol)	MG/KG	NA	NA	NA	0.87 U	0.15 J
4-Nitrophenol	MG/KG	NA	NA	NA	4.3 U	5.4 U
Acenaphthene	MG/KG	0.19 J	4.6 U	0.88 U	0.13 J	0.15 J
Acenaphthylene	MG/KG	1.2 U	4.6 U	0.88 U	0.87 U	1.1 U
Anthracene	MG/KG	0.55 J	2.1 J	0.51 J	0.23 J	0.39 J
Benzo(a)anthracene	MG/KG	2.2	7.1	1.6	0.77 J	1.5
Benzo(a)pyrene	MG/KG	2.1	4.2 J	0.84 J	0.04 J	0.82 J

Flags assigned during chemistry validation are shown.

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U - Not detected above the reported quantitation limit.

J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

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TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		CGAC-SE1	CGAC-SE2	CGAC-SE3	SS-01	SS-02
Sample ID		CGAC-SE1	CGAC-SE2	CGAC-SE3	SS-01	SS-02
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date Sampled		11/27/90	11/27/90	11/27/90	09/09/92	09/09/92
Parameter	Units					
Semivolatile Organic Compounds						
Benzo(b)fluoranthene	MG/KG	2.9	0.83 J	1.7	0.36 J	0.86 J
Benzo(g,h,i)perylene	MG/KG	1.2 U	4.6 U	0.88 U	0.2 J	0.56 J
Benzo(k)fluoranthene	MG/KG	1.2	4.6 U	0.66 J	0.37 J	0.69 J
bis(2-Ethylhexyl)phthalate	MG/KG	0.79 J	2.1 J	0.29 J	0.3 J	0.78 J
Butylbenzylphthalate	MG/KG	1.2 U	4.6 U	0.88 U	1.1 U	0.25 J
Chrysene	MG/KG	2.4	6.9	1.6	0.78 J	1.7
Dibenz(a,h)anthracene	MG/KG	1.2 U	4.6 U	0.88 U	0.87 U	1.1 U
Dibenzofuran	MG/KG	0.16 J	4.6 U	0.88 U	0.09 J	0.085 J
Di-n-butylphthalate	MG/KG	1.2 U	4.6 U	0.88 U	0.23 J	0.23 J
Di-n-octylphthalate	MG/KG	1.2 U	4.6 U	0.88 U	0.87 U	1.1 U
Fluoranthene	MG/KG	5.5	17	3.7	1.7	3.5
Fluorene	MG/KG	0.22 J	0.79 J	0.17 J	0.12 J	0.17 J
Indeno(1,2,3-cd)pyrene	MG/KG	0.67 J	2.2 J	0.45 J	0.87 U	0.49 J
Naphthalene	MG/KG	0.17 J	4.9	0.88 U	0.092 J	1.1 U
N-Nitroso-di-n-propylamine	MG/KG	1.2 U	4.6 U	0.88 U	0.87 U	1.1 U
Pentachlorophenol	MG/KG	NA	NA	NA	4.3 U	5.4 U
Phenanthrene	MG/KG	NA	NA	NA	1.1	2.3
Phenol	MG/KG	NA	NA	NA	0.87 U	1.1 U
Pyrene	MG/KG	NA	NA	NA	1.6	3.1
Total Carcinogenic PAHs	MG/KG	11.47	21.23	6.85	2.32	6.06
Total Non-Carcinogenic PAHs	MG/KG	6.63	24.79	4.38	5.172	10.17
Total Polynuclear Aromatic Hydrocarbons	MG/KG	18.1	46.02	11.23	7.492	16.23
Total Semivolatile Organic Compounds	MG/KG	19.05	48.12	11.52	8.155	17.855

Flags assigned during chemistry validation are shown.

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J - The reported concentration is an estimated value., D - Result reported from a secondary dilution analysis.

B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

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TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		CGAC-SE1	CGAC-SE2	CGAC-SE3	SS-01	SS-02
Sample ID		CGAC-SE1	CGAC-SE2	CGAC-SE3	SS-01	SS-02
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date Sampled		11/27/90	11/27/90	11/27/90	09/09/92	09/09/92
Parameter	Units					
Metals						
Aluminum	MG/KG	NA	NA	NA	4,600	21,370
Antimony	MG/KG	10 U	8.3 U	9.7	0.64 J	0.96 J
Arsenic	MG/KG	NA	NA	NA	7.7	4.6
Barium	MG/KG	NA	NA	NA	59.8	53.2
Cadmium	MG/KG	NA	NA	NA	1.1	0.67
Chromium	MG/KG	NA	NA	NA	11.4	11.2
Copper	MG/KG	NA	NA	NA	55.5	65.2
Iron	MG/KG	NA	NA	NA	23,100	9,690
Lead	MG/KG	NA	NA	NA	117	334
Manganese	MG/KG	NA	NA	NA	15,700	7,810
Mercury	MG/KG	NA	NA	NA	351	169
Nickel	MG/KG	NA	NA	NA	22	12.2
Selenium	MG/KG	4.2 U	3.5 U	3.1 U	2.1 U	2.1 U
Silver	MG/KG	NA	NA	NA	0.48 U	2.6
Vanadium	MG/KG	16	11	16	13.8	606
Zinc	MG/KG	20 U	190	200	141	127
Miscellaneous Parameters						
Cyanide	MG/KG	0.84 U	6.8	0.65 U	1.3 U	1.2 U
Cyanide, Amenable To Chlorination	MG/KG	NA	NA	NA	NA	NA
Total Organic Carbon (TOC)	MG/KG	NA	NA	NA	6,457	15,132

Flags assigned during chemistry validation are shown.

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B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SEDIMENT
N:\11173291.0000\DB\Program\Program.mde
Printed: 10/14/04 11:35:01 AM
(MATRIX) = 'SE'

TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		SS-03	SS-04	SS-05	SS-06	SS-07
Sample ID		SS-03	SS-04	SS-05	SS-06	SS-07
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date Sampled		09/09/92	09/09/92	09/09/92	09/09/92	09/09/92
Parameter	Units					
Volatile Organic Compounds						
Acetone	MG/KG	0.018	0.013 U	0.25	0.016 U	0.078
Benzene	MG/KG	0.008 U	0.006 U	0.007 U	0.008 U	0.096
Carbon disulfide	MG/KG	0.008 U	0.006 U	0.007 U	0.008 U	0.008 U
Ethylbenzene	MG/KG	0.008 U	0.006 U	0.007 U	0.008 U	0.15
Methylene chloride	MG/KG	0.01 B	0.012 B	0.012 B	0.013 B	0.016 B
Toluene	MG/KG	0.005 J	0.006 U	0.007 U	0.008 U	0.005 J
Xylene (total)	MG/KG	0.008 U	0.006 U	0.007 U	0.008 U	0.098
Total Volatile Organic Compounds	MG/KG	0.033	0.012	0.262	0.013	0.443
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	MG/KG	2.4 U	1.2 U	0.99 U	3 D	2.1 U
1,4-Dichlorobenzene	MG/KG	2.4 U	1.2 U	0.99 U	2.4 D	2.1 U
2,4-Dinitrotoluene	MG/KG	2.4 U	1.2 U	0.99 U	2.8 D	2.1 U
2-Chlorophenol	MG/KG	2.4 U	1.2 U	0.99 U	5.9 D	2.1 U
2-Methylnaphthalene	MG/KG	2.4 U	1.2 U	0.35 J	2.4 U	2.1 U
2-Methylphenol (o-cresol)	MG/KG	2.4 U	1.2 U	0.99 U	2.4 U	0.9 JD
4-Chloro-3-methylphenol	MG/KG	2.4 U	1.2 U	0.99 U	7.2 D	2.1 U
4-Methylphenol (p-cresol)	MG/KG	2.4 U	0.11 J	0.99 U	2.4 U	2.1 U
4-Nitrophenol	MG/KG	12 U	6.2 U	4.9 U	6 JD	11 U
Acenaphthene	MG/KG	0.4 JD	0.14 J	0.99	4.5 D	1.9 JD
Acenaphthylene	MG/KG	0.55 JD	1.2 U	0.99 U	0.34 JD	0.21 JD
Anthracene	MG/KG	1.7 JD	0.36 J	2.1	3.8 D	2.5 D
Benzo(a)anthracene	MG/KG	7.3 D	1.1 J	3.8	8.9 D	4 D
Benzo(a)pyrene	MG/KG	7 D	0.69 J	1.8	7.9 D	3.4 D

Flags assigned during chemistry validation are shown.

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B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SEDIMENT
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Printed: 10/14/04 11:35 01 AM
[MATRIX] = 'SE'

TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		SS-03	SS-04	SS-05	SS-06	SS-07
Sample ID		SS-03	SS-04	SS-05	SS-06	SS-07
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date Sampled		09/09/92	09/09/92	09/09/92	09/09/92	09/09/92
Parameter	Units					
Semivolatile Organic Compounds						
Benzo(b)fluoranthene	MG/KG	8.3 D	0.71 J	1.6	8.8 D	3.2 D
Benzo(g,h,i)perylene	MG/KG	6.7 D	0.44 J	1	5 D	1.9 JD
Benzo(k)fluoranthene	MG/KG	4.6 D	0.57 J	1.5	5.3 D	2.5 D
bis(2-Ethylhexyl)phthalate	MG/KG	2.4 U	0.94 J	0.18 J	0.67 JD	0.99 JD
Butylbenzylphthalate	MG/KG	2.4 U	1.2 U	0.99 U	2.4 U	2.1 U
Chrysene	MG/KG	7.1 D	1.4	3.5	8.5 D	4.2 D
Dibenz(a,h)anthracene	MG/KG	2.6 D	1.2 U	0.34 J	2.6 D	2.1 D
Dibenzofuran	MG/KG	0.29 JD	0.089 J	0.66 J	0.78 JD	0.4 JD
Di-n-butylphthalate	MG/KG	0.12 D	0.25 J	0.18 J	0.33 JD	0.15 JD
Di-n-octylphthalate	MG/KG	2.4 U	1.2 U	0.99 U	2.4 U	2.1 U
Fluoranthene	MG/KG	10 D	3	8	2.4 U	9.4 D
Fluorene	MG/KG	0.57 JD	0.17 J	1	2.4 U	1.2 JD
Indeno(1,2,3-cd)pyrene	MG/KG	5.4 D	0.42 J	1	5.2 D	1.9 JD
Naphthalene	MG/KG	0.34 JD	0.062 J	0.76 J	2.4 U	12 D
N-Nitroso-di-n-propylamine	MG/KG	2.4 U	1.2 U	0.99 U	2.7 D	2.1 U
Pentachlorophenol	MG/KG	12 U	6.2 U	4.9 U	7 JD	11 U
Phenanthrene	MG/KG	7.3 D	1.9	8.2	14 D	8.1 D
Phenol	MG/KG	2.4 U	1.2 U	0.99 U	5.8 D	2.1 U
Pyrene	MG/KG	12 D	2.5	9.9	19 D	8 D
Total Carcinogenic PAHs	MG/KG	42.3	4.89	13.54	47.2	21.3
Total Non-Carcinogenic PAHs	MG/KG	39.56	8.572	31.95	46.64	45.21
Total Polynuclear Aromatic Hydrocarbons	MG/KG	81.86	13.462	45.49	93.84	66.51
Total Semivolatile Organic Compounds	MG/KG	82.27	14.851	46.86	138.42	68.95

Flags assigned during chemistry validation are shown.

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B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SEDIMENT
N:\11173291 00000\DB\Program\Program.mde
Printed: 10/14/04 11:35 01 AM
[MATRIX] = 'SE'

TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		SS-03	SS-04	SS-05	SS-06	SS-07
Sample ID		SS-03	SS-04	SS-05	SS-06	SS-07
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date Sampled		09/09/92	09/09/92	09/09/92	09/09/92	09/09/92
Parameter	Units					
Metals						
Aluminum	MG/KG	3,720	3,510	3,390	4,080	3,830
Antimony	MG/KG	21.4 J	0.78 J	5.1 J	0.45 J	1 J
Arsenic	MG/KG	5.4	4.8	4.2	3.2	2.4
Barium	MG/KG	85.3	55.4	86.5	72.8	63.1
Cadmium	MG/KG	2.8	0.98	0.87	0.92	1.1
Chromium	MG/KG	54.7	15.3	35.7	18.1	27.2
Copper	MG/KG	954	97.5	464	184	116
Iron	MG/KG	57,100	23,800	20,900	22,900	19,200
Lead	MG/KG	3,800	260	317	221	278
Manganese	MG/KG	9,210	13,300	10,600	11,000	10,100
Mercury	MG/KG	276	372	206	278	193
Nickel	MG/KG	19.5	17.6	4,508	492	24
Selenium	MG/KG	0.98	2.6 U	0.46	0.29 U	0.28 U
Silver	MG/KG	2.6	0.72 J	0.76 J	0.58 U	3.7
Vanadium	MG/KG	13.5	11.3	9.2	13	10.7
Zinc	MG/KG	499	161	163	222	177
Miscellaneous Parameters						
Cyanide	MG/KG	1.8 U	1.3 U	1.5 U	1.6 U	1.8
Cyanide, Amenable To Chlorination	MG/KG	NA	NA	NA	NA	1.8
Total Organic Carbon (TOC)	MG/KG	58,323	6,214	6,457 U	27,289	15,320

Flags assigned during chemistry validation are shown.

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B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection: SEDIMENT
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[MATRIX] = 'SE'

TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		SS-08	SS-09	SS-09
Sample ID		SS-08	SS-09	SS-09DUP
Matrix		Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-
Date Sampled		09/09/92	09/09/92	09/09/92
Parameter	Units			Field Duplicate (1-1)
Volatile Organic Compounds				
Acetone	MG/KG	0.075	0.031	0.04
Benzene	MG/KG	0.008 U	0.007 U	0.007 U
Carbon disulfide	MG/KG	0.004 J	0.007 U	0.007 U
Ethylbenzene	MG/KG	0.008 U	0.007 U	0.007 U
Methylene chloride	MG/KG	0.011 B	0.014 U	0.013
Toluene	MG/KG	0.008 U	0.007 U	0.007 U
Xylene (total)	MG/KG	0.008 U	0.007 U	0.007 U
Total Volatile Organic Compounds	MG/KG	0.09	0.031	0.053
Semivolatile Organic Compounds				
1,2,4-Trichlorobenzene	MG/KG	2.2 U	0.95 U	0.94 U
1,4-Dichlorobenzene	MG/KG	2.2 U	0.95 U	0.94 U
2,4-Dinitrotoluene	MG/KG	2.2 U	0.95 U	0.94 U
2-Chlorophenol	MG/KG	2.2 U	0.95 U	0.94 U
2-Methylnaphthalene	MG/KG	0.15 JD	0.073 J	0.038 J
2-Methylphenol (o-cresol)	MG/KG	2.2 U	0.95 U	0.94 U
4-Chloro-3-methylphenol	MG/KG	2.2 U	0.95 U	0.94 U
4-Methylphenol (p-cresol)	MG/KG	0.12 JD	0.95 U	0.94 U
4-Nitrophenol	MG/KG	11 U	4.7 U	4.7 U
Acenaphthene	MG/KG	4.7 D	3.3	2.8
Acenaphthylene	MG/KG	0.34 JD	0.17 J	0.1 J
Anthracene	MG/KG	2.5 D	1	0.48 J
Benzo(a)anthracene	MG/KG	6.4 D	2.3	1.2
Benzo(a)pyrene	MG/KG	3.4 D	1.7	0.97

Flags assigned during chemistry validation are shown.

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B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		SS-08	SS-09	SS-09
Sample ID		SS-08	SS-09	SS-09DUP
Matrix		Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-
Date Sampled		09/09/92	09/09/92	09/09/92
Parameter	Units			Field Duplicate (1-1)
Semivolatile Organic Compounds				
Benzo(b)fluoranthene	MG/KG	3.6 D	2.2	1.2
Benzo(g,h,i)perylene	MG/KG	2.7 D	1.3	0.72 J
Benzo(k)fluoranthene	MG/KG	2.6 D	1.4	0.73 J
bis(2-Ethylhexyl)phthalate	MG/KG	1.8 JD	1.5	1.3
Butylbenzylphthalate	MG/KG	2.2 U	0.12 J	0.26 J
Chrysene	MG/KG	6.9 D	2.3	1.2
Dibenz(a,h)anthracene	MG/KG	2.2 U	0.61 J	0.29 J
Dibenzofuran	MG/KG	0.62 JD	0.19 J	0.11 J
Di-n-butylphthalate	MG/KG	0.3 JD	0.46 J	0.23 J
Di-n-octylphthalate	MG/KG	2.2 U	0.95 U	0.074 J
Fluoranthene	MG/KG	15 D	6.1	3
Fluorene	MG/KG	3 D	0.7 J	0.46 J
Indeno(1,2,3-cd)pyrene	MG/KG	2.2 JD	1.3	0.7 J
Naphthalene	MG/KG	0.33 JD	0.19 J	0.11 J
N-Nitroso-di-n-propylamine	MG/KG	2.2 U	0.95 U	0.94 U
Pentachlorophenol	MG/KG	14 D	4.7 U	4.7 U
Phenanthrene	MG/KG	2.2 U	3.9	1.7
Phenol	MG/KG	14 D	0.95 U	0.94 U
Pyrene	MG/KG	2.2 U	4.2	2.3
Total Carcinogenic PAHs	MG/KG	25.1	11.81	6.29
Total Non-Carcinogenic PAHs	MG/KG	28.57	20.86	11.67
Total Polynuclear Aromatic Hydrocarbons	MG/KG	53.67	32.67	17.96
Total Semivolatile Organic Compounds	MG/KG	84.66	35.013	19.972

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B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

TABLE 5
SUMMARY OF HISTORICAL SEDIMENT ANALYTICAL RESULTS
FORMER CLARK STREET MGP SITE

Location ID		SS-08	SS-09	SS-09
Sample ID		SS-08	SS-09	SS-09DUP
Matrix		Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-
Date Sampled		09/09/92	09/09/92	09/09/92
Parameter	Units			Field Duplicate (1-1)
Metals				
Aluminum	MG/KG	3,360	3,410	3,010
Antimony	MG/KG	2.3 J	0.5 J	1.8 J
Arsenic	MG/KG	3.6	2.6	14.6
Barium	MG/KG	65.4	40.8	43.1
Cadmium	MG/KG	1.1	1.3	0.71
Chromium	MG/KG	19.3	15.4	15.5
Copper	MG/KG	119	123	161
Iron	MG/KG	14,200	23,500	19,600
Lead	MG/KG	197	197	115
Manganese	MG/KG	10,200	9,260	9,670
Mercury	MG/KG	180	219	217
Nickel	MG/KG	20.9	37.7	36.5
Selenium	MG/KG	2.7 U	2.2 U	2.3 U
Silver	MG/KG	0.71 J	0.49 U	0.59 U
Vanadium	MG/KG	11.5	8	7.3
Zinc	MG/KG	206	919	466
Miscellaneous Parameters				
Cyanide	MG/KG	1.6 U	1.8	1.4 U
Cyanide, Amenable To Chlorination	MG/KG	NA	1.8	NA
Total Organic Carbon (TOC)	MG/KG	23,299	21,331	23,593

Flags assigned during chemistry validation are shown.

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B - The reported concentration is above the method detection limit but below the quantitation limit.

Only Detected Results Reported.

Detection Limits shown are MDL

Advanced Selection, SEDIMENT
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TABLE 6

SUMMARY OF MONITORING WELL DETAILS

FORMER CLARK STREET MGP SITE

WELL NUMBER	GENERAL LOCATION	GROUND ELEVATION	TOP OF WELL ELEVATION	BOTTOM OF BORING ELEVATION	SCREEN INTERVAL
MW-1	Southeastern side of site.	636.8	639.39	622.3	622.6-632.3
MW-2	Southwestern side of site.	633.6	636.15	621.8	622.1-631.8
MW-3	Western side of site, adjacent to the Owasco Outlet.	633.0	636.13	619.3	619.6-629.3
MW-4	Northwestern side of site, adjacent to the Owasco Outlet.	632.6	635.08	620.1	620.4-630.1
MW-5	Eastern side of site, adjacent to the Owasco Outlet.	633.7	633.54	620.2	620.5-630.2

Notes:

1. Elevation reported in feet above mean sea level (NGVD29)
2. Elevations based on site datum provided by S.Y. Kim Land Surveyor (AES, 1991).
3. Horizontal coordinates not surveyed. See Figure 2 for approximate locations.
4. Wells are constructed of 2-inch diameter stainless steel with 0.010-inch slot screen.
5. All wells are screened in overburden materials.

TABLE 7

SAMPLE LOCATION RATIONALE

FORMER CLARK STREET MGP SITE

LOCATION ID	TYPE	RATIONALE
BGS-01	Surface soil sample	Background sample
BGS-02	Surface soil sample	Background sample
BGS-03	Surface soil sample	Background sample
GB-01	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#1
GB-02	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#1
GB-03	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#1
GB-04	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#3
GB-05	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#3
GB-06	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#3
GB-07	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former oil tank and tar pump
GB-08	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former oil tank and tar pump
GB-09	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former oil tank and tar pump
GB-10	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#2
GB-11	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#2
GB-12	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former GH#2
GB-13	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former gas house and purifying room
GB-14	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former gas house and purifying room
GB-15	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former gas house and purifying room
GB-16	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former coke ovens
GB-17	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former coal shed
GB-18	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near former coal shed
GB-19	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals northeast of the GH#1
GB-20	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near the central portion of GH#2

TABLE 7

SAMPLE LOCATION RATIONALE

FORMER CLARK STREET MGP SITE

LOCATION ID	TYPE	RATIONALE
GB-21	Soil boring/soil sample	Delineate horizontal and vertical extent of MGP residuals near the central portion of the substation transformer area
MW-01B	Shallow bedrock monitoring well/groundwater sample	Assess groundwater quality in shallow bedrock up-gradient of source areas and evaluate vertical hydraulic gradient
MW-02B	Shallow bedrock monitoring well/groundwater sample	Assess groundwater quality in shallow bedrock up-gradient of source areas and evaluate vertical hydraulic gradient
MW-03B	Shallow bedrock monitoring well/groundwater sample	Assess groundwater quality in shallow bedrock down-gradient of GH #1 and evaluate vertical hydraulic gradient
MW-04B	Shallow bedrock monitoring well/groundwater sample	Assess groundwater quality in shallow bedrock down-gradient of GH#1, GH#2, and GH#3 and evaluate vertical hydraulic gradient
MW-05B	Shallow bedrock monitoring well/groundwater sample	Assess groundwater quality in shallow bedrock east of GH #2 and evaluate vertical hydraulic gradient
MW-06B	Shallow bedrock monitoring well/groundwater sample	Assess groundwater quality in shallow bedrock northeast of the substation transformer area and evaluate vertical hydraulic gradient
MW-01	Overburden monitoring well/groundwater sample	Assess groundwater quality in overburden up-gradient of source areas and evaluate vertical hydraulic gradient
MW-02	Overburden monitoring well/groundwater sample	Assess groundwater quality in overburden up-gradient of source areas and evaluate vertical hydraulic gradient
MW-03	Overburden monitoring well/groundwater sample	Assess groundwater quality in overburden down-gradient of GH#1 and evaluate vertical hydraulic gradient
MW-04	Overburden monitoring well/groundwater sample	Assess groundwater quality in overburden down-gradient of GH 1, GH#2, and GH#3 and evaluate vertical hydraulic gradient
MW-05	Overburden monitoring well/groundwater sample	Assess groundwater quality in overburden east of GH#2 and evaluate vertical hydraulic gradient
MW-06	Overburden monitoring well/groundwater sample	Assess groundwater quality in shallow bedrock northeast of the substation transformer area and evaluate vertical hydraulic gradient
SW/SED-01	Surface water/sediment sample	Assess Owasco Lake Outlet upstream of site
SED-02	Sediment sample	Assess Owasco Lake Outlet upstream of site
SW/SED-03	Sediment sample	Assess Owasco Lake Outlet east of site
SED-04	Sediment sample	Assess Owasco Lake Outlet north of site
SW/SED-05	Surface water/sediment sample	Assess Owasco Lake Outlet north of site
SED-06	Sediment sample	Assess Owasco Lake Outlet north-northwest of site
SW/SED-07	Sediment sample	Assess Owasco Lake Outlet northwest of site
SED-08	Sediment sample	Assess Owasco Lake Outlet northwest of site

TABLE 7**SAMPLE LOCATION RATIONALE****FORMER CLARK STREET MGP SITE**

LOCATION ID	TYPE	RATIONALE
SW/SED-09	Surface water/sediment sample	Assess Owasco Lake Outlet downstream of site
SED-10	Sediment sample	Assess Owasco Lake Outlet downstream of site
ST-01	Stream bank surface soil sample	Assess conditions at the public access area opposite the site
ST-01 (SED-11)	Near shore sediment sample	Assess conditions at the public access area opposite the site
TT-01	Test trench/soil sample	Visually inspect the water table for evidence of contamination, if any, and characterize the soils on the northwestern perimeter of the site.
TT-02	Test trench/soil sample	Visually inspect the water table for evidence of contamination, if any, and characterize the soils on the northern perimeter of the site
TT-03	Test trench/soil sample	Visually inspect the water table for evidence of contamination, if any, and characterize the soils on the northeastern perimeter of the site
TT-04	Test trench/soil sample	Visually inspect the water table for evidence of contamination, if any, and characterize the soils on the eastern perimeter of the site
TT-05	Test trench/soil sample	Visually inspect the water table for evidence of contamination, if any, and characterize the soils on the eastern perimeter of the site
TT-06	Test trench/soil sample	Visually inspect the water table for evidence of contamination, if any, and characterize the soils in the center of the site, and aid in determining the location of former piping connecting former MGP structures
TT-07	Test trench/soil sample	Visually inspect the water table for evidence of contamination, if any, and characterize the soils in the center of the site, and aid in determining the location of former piping connecting former MGP structures

TABLE 8

ANALYTICAL SUMMARY FOR SRI SCOPE OF WORK

FORMER CLARK STREET MGP SITE

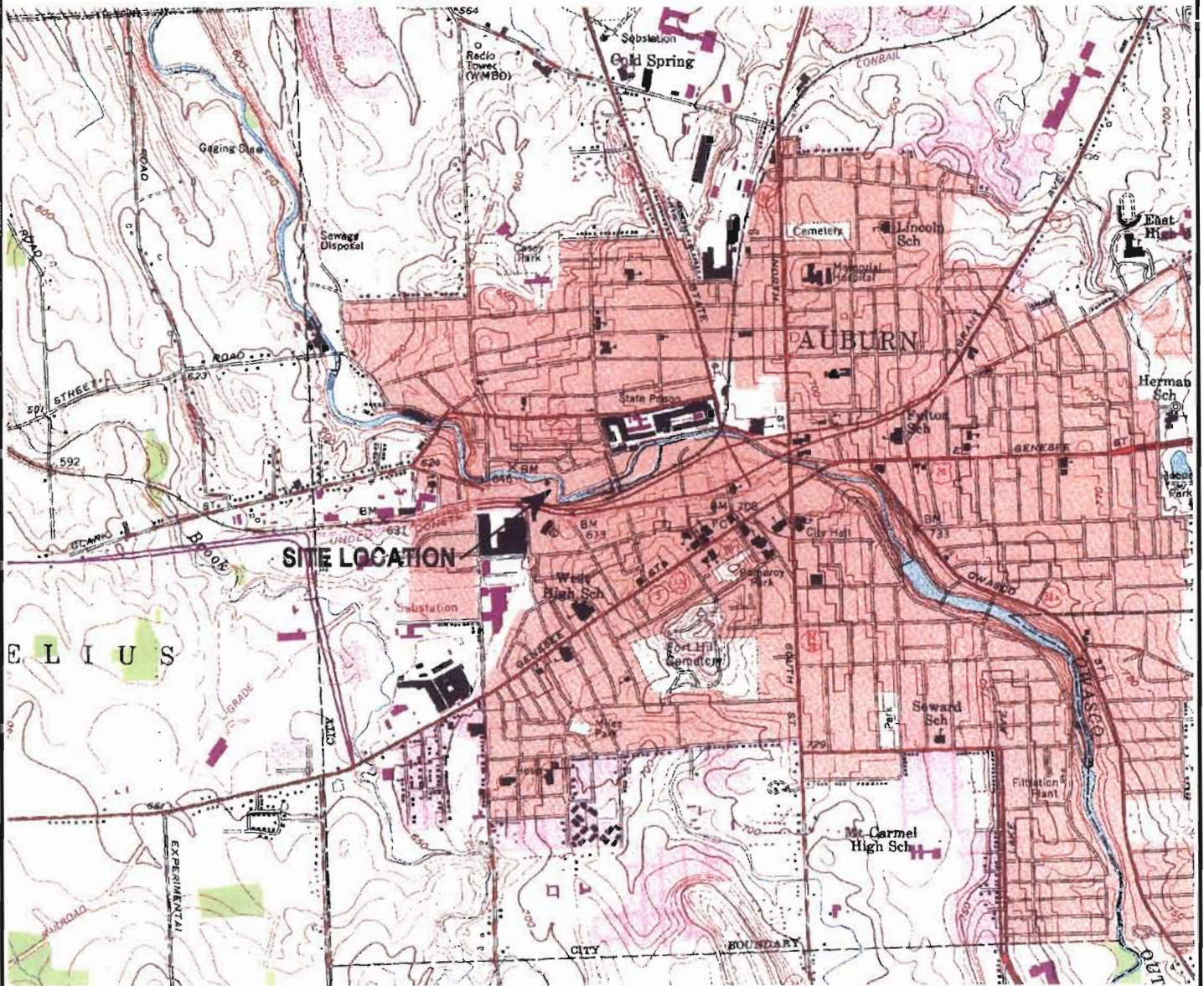
MATRIX	ANTICIPATED NUMBER OF SAMPLES ¹	TARGET ANALYTES	LABORATORY ANALYSIS
Soil ²	35 (soil borings) 6 (monitoring well locations) 7 (test trenches)	BTEX	EPA 8260B
		TCL SVOCs	EPA 8270
		SVOCs (expanded PAHs)	EPA 8270 modified
		TCL PCBs	EPA 8082
		Total Phenols	EPA 9065
		TAL Metals	EPA 6010B/7471A/7470A
		Cyanide (total & free)	EPA 9012A
		Cyanide (speciation)	*
		Total Organic Carbon (TOC)	Lloyd Kahn
		Natural Oxidant Demand (NOD)	
		Reactivity	SW846 Ch. 7, Sec. 7.3
		Total Sulfur	ASTM 129.64
		TCLP Benzene	EPA 1311/8260B
Sediment ²	Minimum of 10 1 stream bank surface soil 1 near shore sediment	BTEX	EPA 8260B
		TCL SVOCs	EPA 8270
		SVOCs (expanded PAHs)	EPA 8270 modified
		TCL PCBs	EPA 8082
		Total Phenols	EPA 9065
		TAL Metals	EPA 6010B/7471A/7470A
		Cyanide (total & free)	EPA 9012A
		Cyanide (speciation)	*
Surface Water	Minimum of 5	Total Organic Carbon (TOC)	Lloyd Kahn
		TCL VOCs	EPA 8260B
		TCL SVOCs	EPA 8270
		SVOCs (expanded PAHs)	EPA 8270 modified
		TCL PCBs	EPA 8082
		Total Phenols	EPA 9065
		TAL Metals	EPA 6010B/7471A/7470A
Groundwater	24 (two sampling events)	Cyanide (total & free)	EPA 9012A
		TCL VOCs	EPA 8260B
		TCL SVOCs	EPA 8270
		SVOCs (expanded PAHs)	EPA 8270 modified
		TCL PCBs	EPA 8082
		Total Phenols	EPA 9065
		TAL Metals	EPA 6010B/7471A/7470A
		Cyanide (total & free) ³	EPA 9012A
		Cyanide (speciation) ³	*
		Alkalinity	EPA 310.1
		Chloride	EPA 300.0
		Nitrate/Nitrite	EPA 300.0
		Sulfate/Sulfide	EPA 300.0/376.2
		Dissolved Iron	EPA 6010B
		Ferrous Iron	**
		Total Dissolved Solids (TDS)	EPA 160.1

Notes:

- Does not include trip blanks, duplicate samples, or MS/MSD.
- Selected samples will also be analyzed for hydrocarbon fingerprint by EPA Method 8100 and extended PAH profiles by modified EPA Method 8270.
- Total cyanide analyses will be completed within seven days so that, if necessary, free cyanide and cyanide speciation determinations can be completed within holding times.

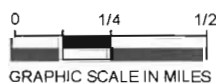
*: Indicates analysis for ferrous and ferric cyanide by ion chromatography.

**: Indicates parameter measured in field using HACH test kit.



P:\In Progress\NYSEG\Auburn\October 2004 SRI Workplan\Figures\Site Location Map.ai 11/10/03

SOURCE:
USGS 7 1/2 Minute Series Topographic Map
Auburn, New York 1954 (Photorevised 1978)



Title: SITE LOCATION MAP

Location: CLARK STREET
FORMER MGP SITE
AUBURN, NEW YORK

Client:  NYSEG

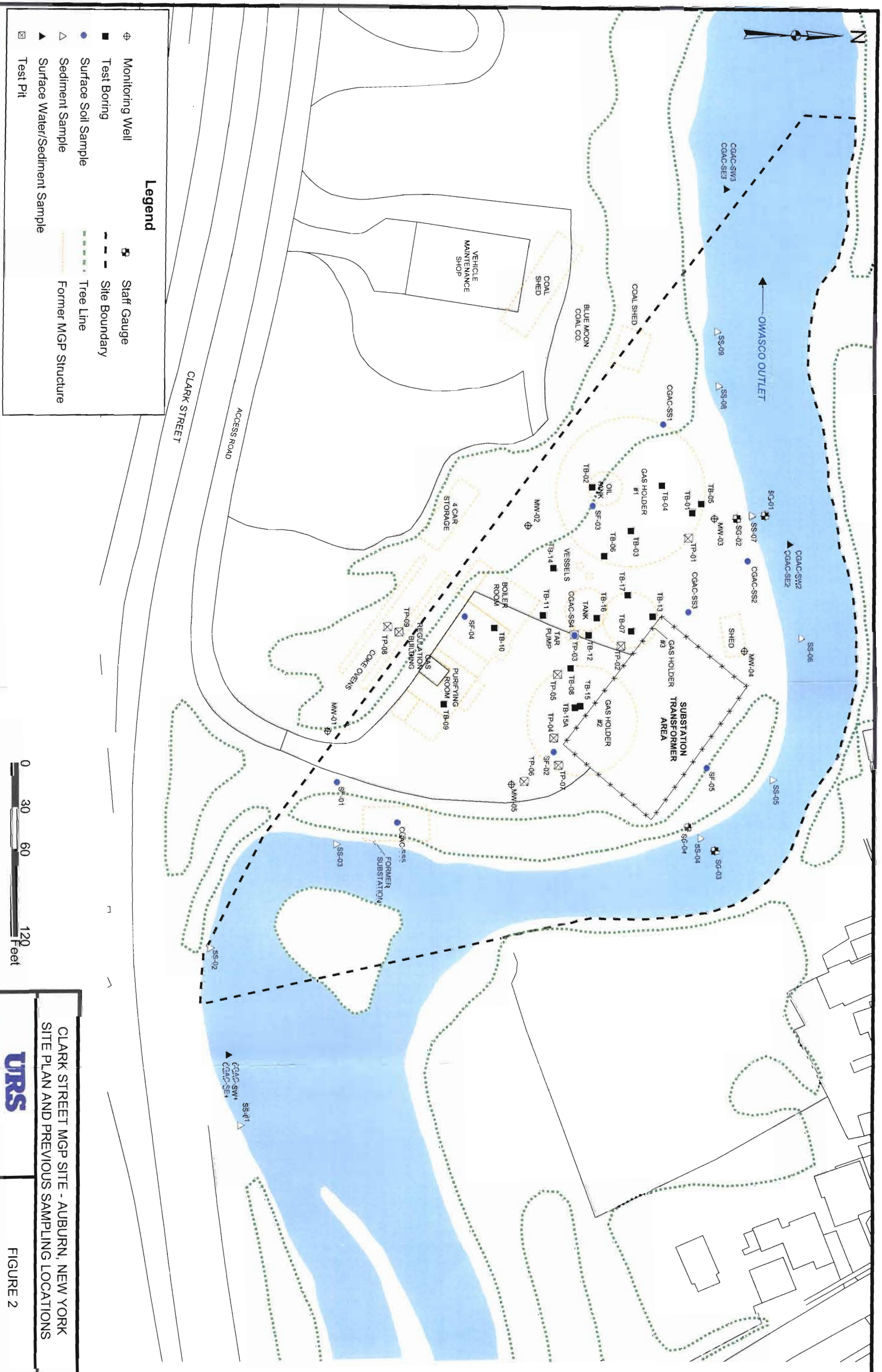
URS

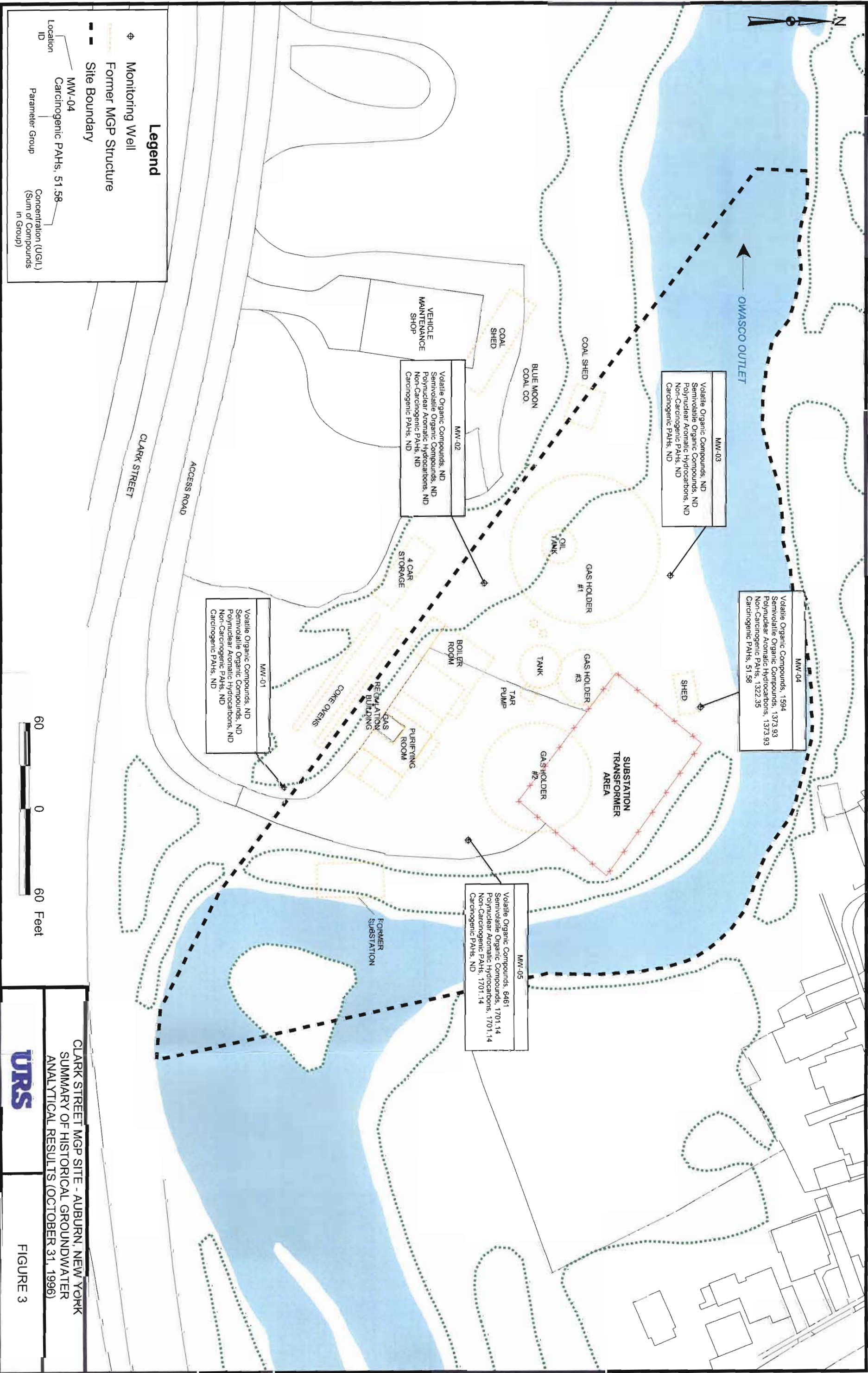
URS Corporation
28 Corporate Drive, Suite 200
Clifton Park, New York 12065

Drafter: BKG Date: October 2004

Drg. Size: 8.5 x 11 Job No.: 11173291.00000

FIGURE 1

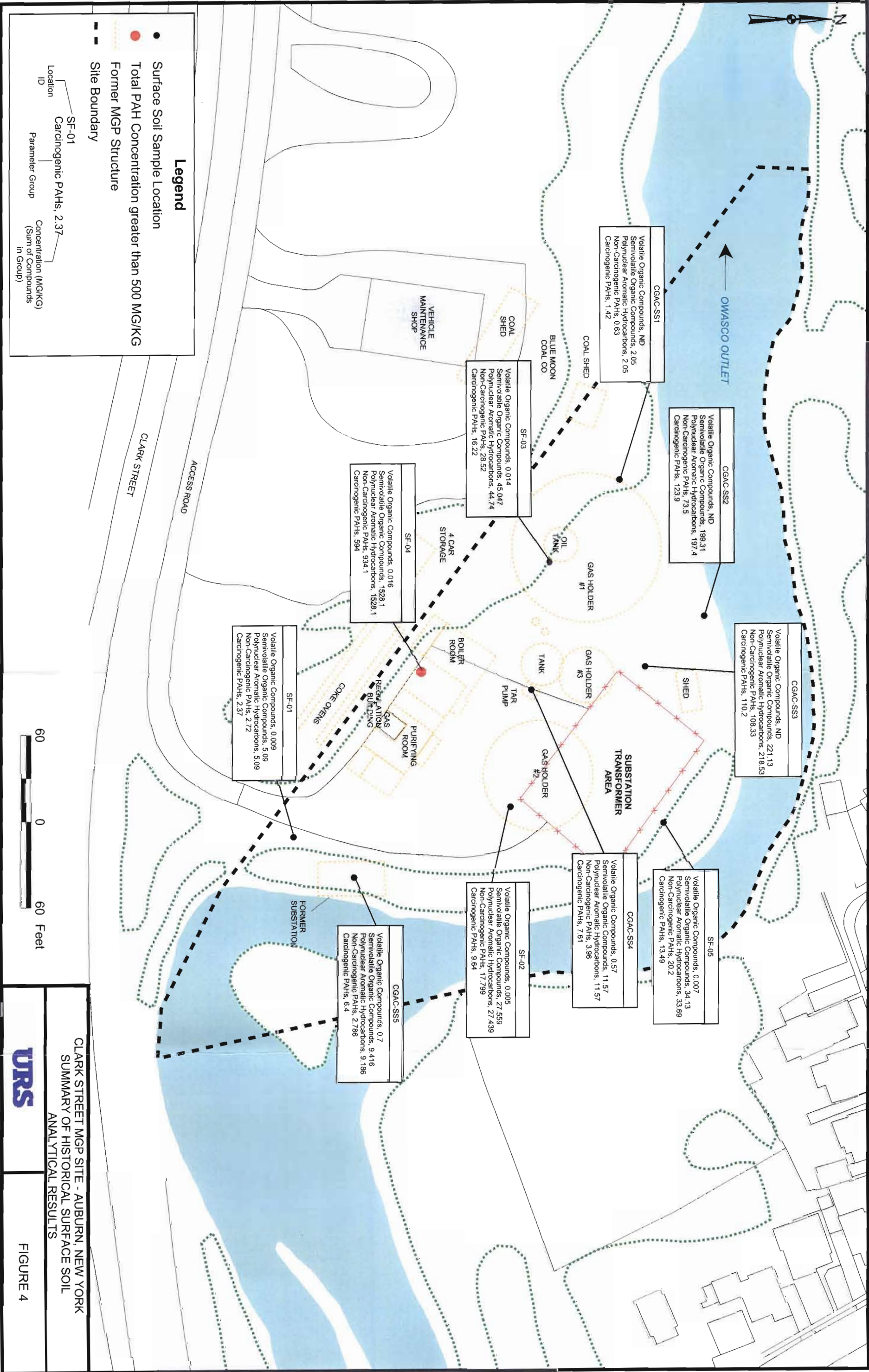




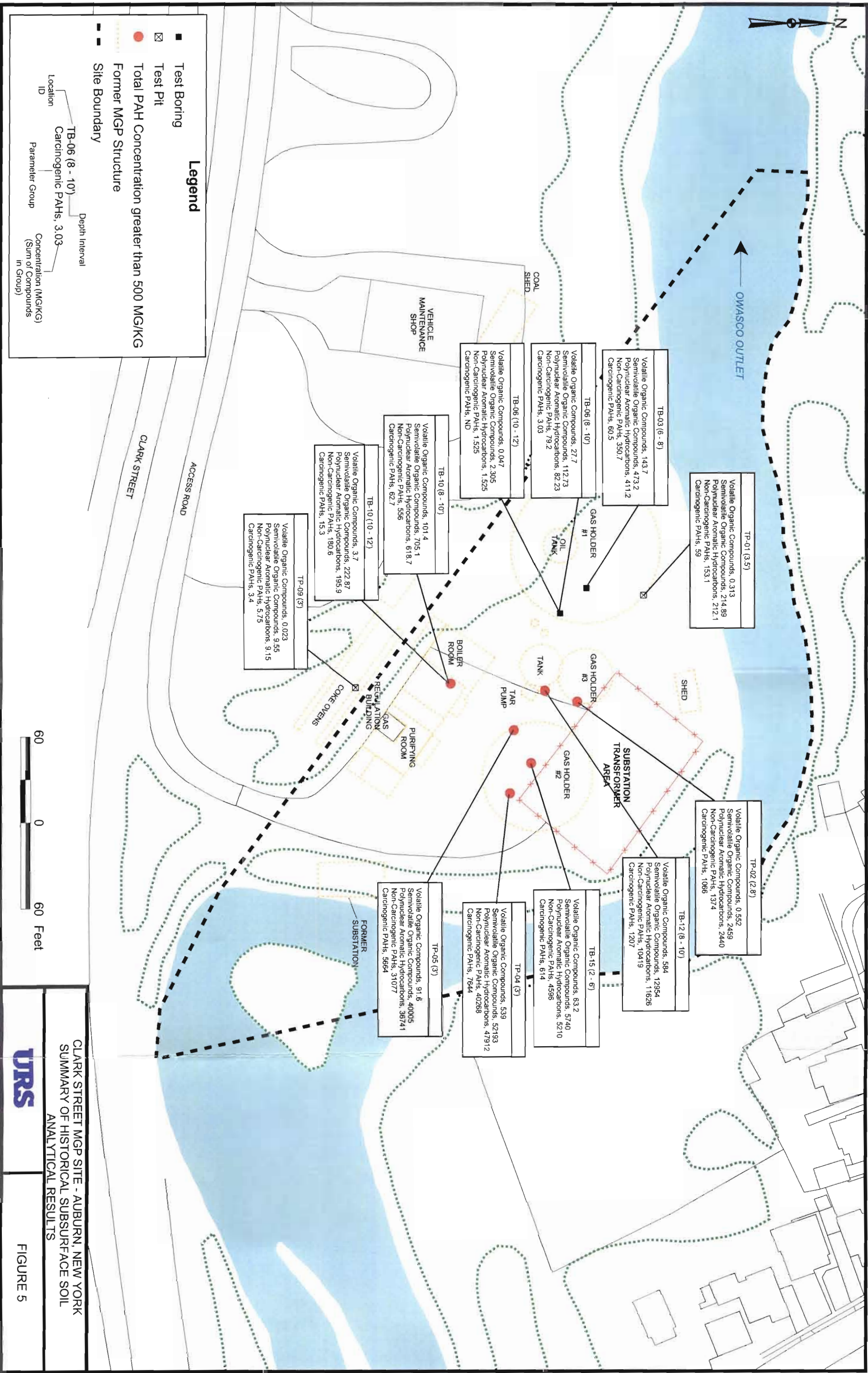
CLARK STREET MGP SITE - AUBURN, NEW YORK
SUMMARY OF HISTORICAL GROUNDWATER
ANALYTICAL RESULTS (OCTOBER 31, 1996)

URS

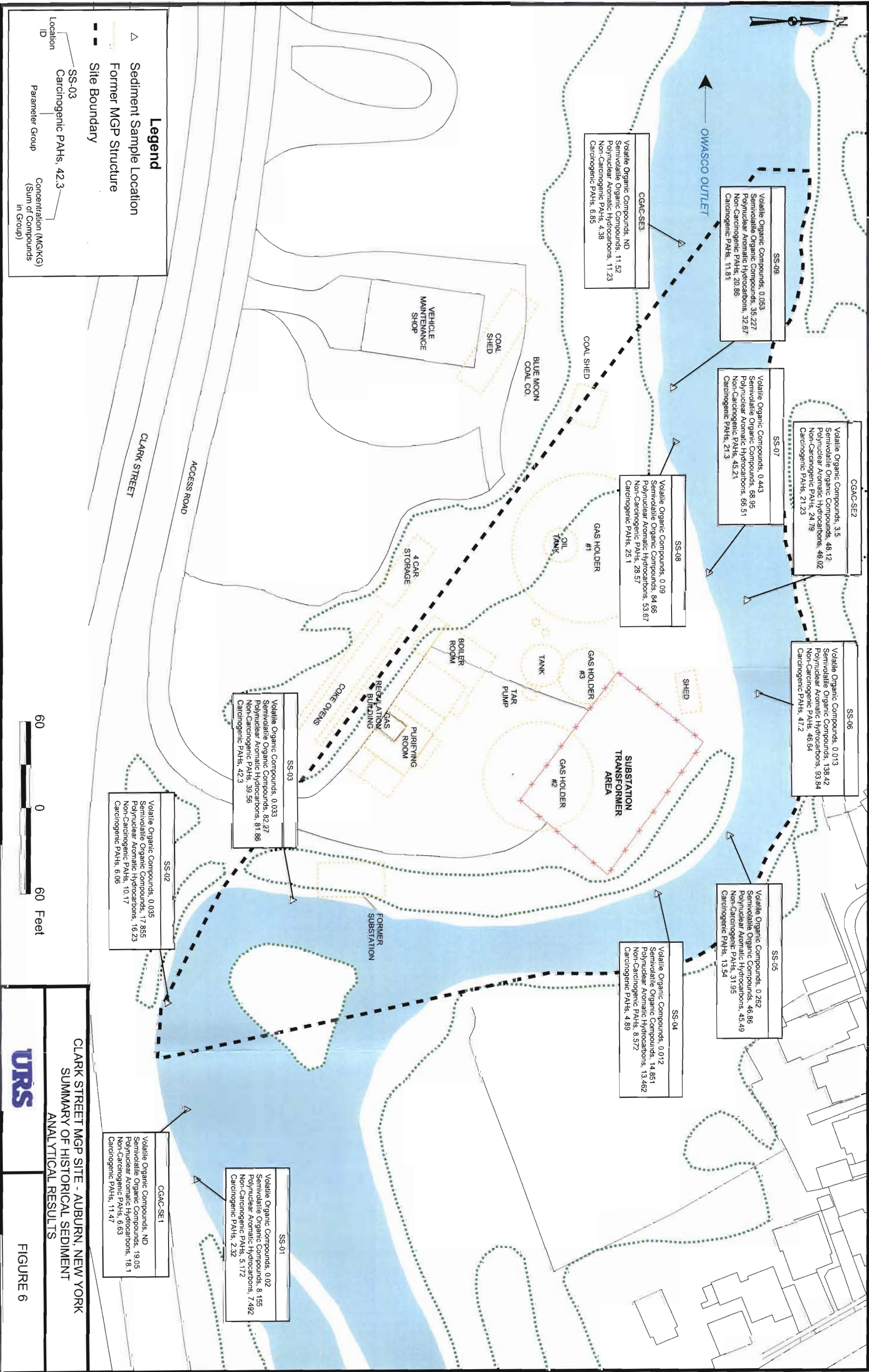
FIGURE 3



CLARK STREET MGP SITE - AUBURN, NEW YORK
SUMMARY OF HISTORICAL SURFACE SOIL
ANALYTICAL RESULTS



CLARK STREET MGP SITE - AUBURN, NEW YORK
SUMMARY OF HISTORICAL SUBSURFACE SOIL
ANALYTICAL RESULTS



CLARK STREET MGP SITE - AUBURN, NEW YORK
SUMMARY OF HISTORICAL SEDIMENT
ANALYTICAL RESULTS



FIGURE 6

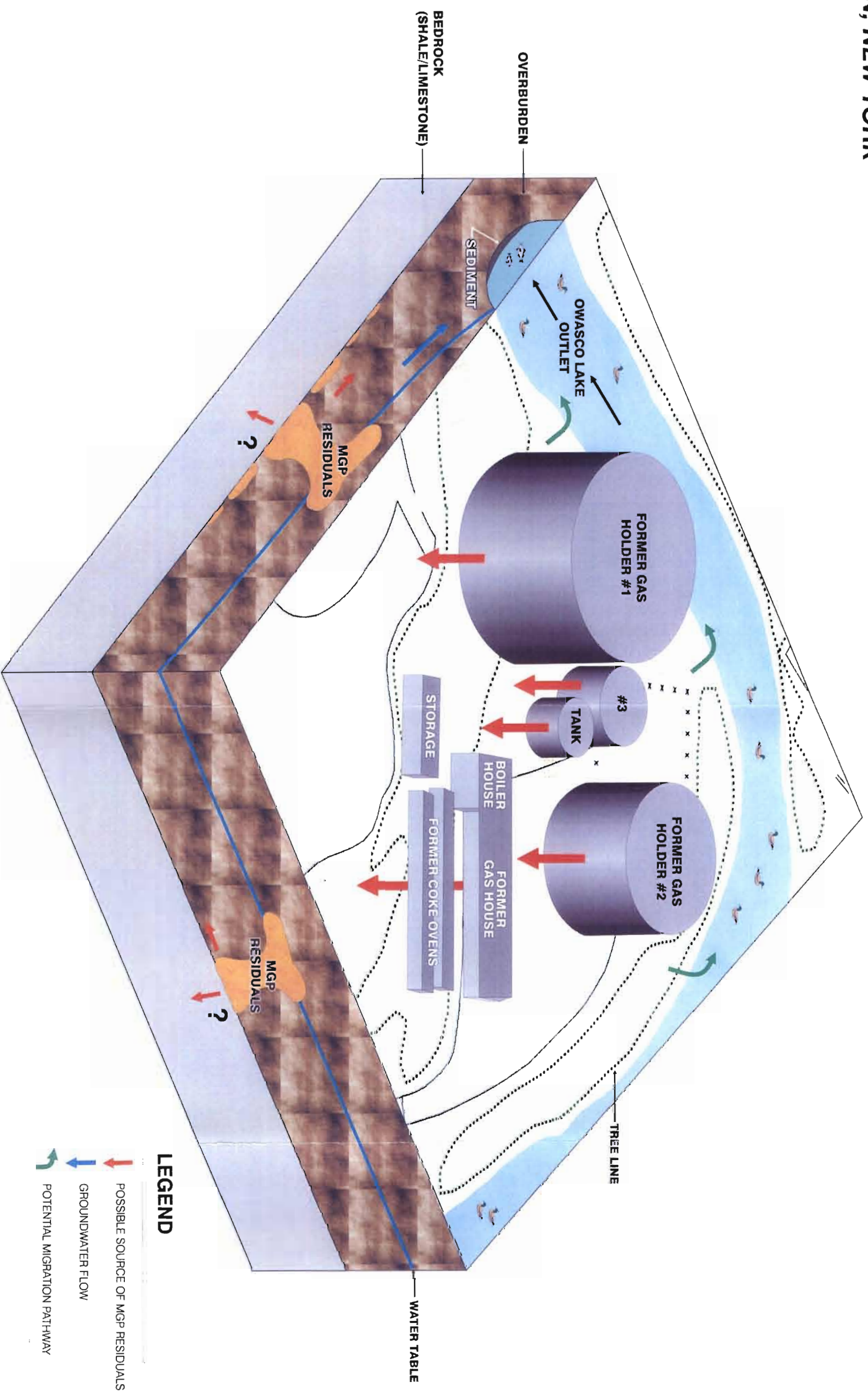


Figure 7



CLARK STREET MGP SITE - AUBURN, NEW YORK
PROPOSED SRI SAMPLING LOCATIONS

FIGURE 9**PROPOSED SCHEDULE**

TASK	ANTICIPATED DURATION OF TASK	DATE OF TASK COMPLETION
Scoping Letter to NYSDEC	1 day	October 15, 2003
Site Visit	1 day	October 28, 2003
Submit Draft Work Plan to NYSDEC	6 weeks	December 16, 2003
NYSDEC Review Work Plan	6 weeks	October 11, 2004
Revise Work Plan	2 weeks	October 18, 2004
Submit Final Work Plan	1 day	October 18, 2004
Notice To Proceed – Field Work	0	October 11, 2004
Task 1 – Soil Borings and Soil Sampling And Task 4 – Test Trenches	2 weeks	November 19, 2004
Task 2 – Monitoring Well Installation/Development	2 weeks	December 3, 2004
Monitoring Well Equilibration	2 weeks	December 17, 2004
Task 3 – Groundwater Sampling	1 week	January 7, 2005.
Task 5 – Surface Water and Sediment Sampling	2 weeks	December 17, 2004
Laboratory Analyses	5 weeks	February 11, 2005
Task 6 – Step IIA Fish and Wildlife Impact Analysis	1 week	February 18, 2005
Task 7 – Analyze Data and Prepare Report	10 (from completion of field work)	March 18, 2005
Submit Draft SRI Report to NYSDEC	1 day	March 21, 2005
NYSDEC Review Draft SRI Report	8 weeks	May 13, 2005
Revise SRI Report	2 weeks	May 27, 2005
Submit Final SRI Report	1 day	May 30, 2005

QUALITY ASSURANCE PROJECT PLAN

for

New York State Electric and Gas
Former Clark Street MGP
Auburn, New York

October 13, 2004

Prepared for:

NYSEG
Corporate Drive
Kirkwood Industrial Park
Binghamton, New York

Prepared by:

URS Corporation - New York
28 Corporate Drive, Suite 200
Clifton Park, NY 12065

And

URS Corporation - New York
77 Goodell Street, 4th Floor
Buffalo, New York 14203

A1 TITLE

QUALITY ASSURANCE PROJECT PLAN FOR NYSEG, FORMER CLARK STREET MGP

A1.1 Organization

New York State Electric and Gas

A1.2 Responsible Officials

Name: John J. Ruspantini, CHMM
Title: Project Environmental Specialist, NYSEG
Phone: (607) 762-8839

Signature: _____ Date: _____

Name: Jack Wilcox
Title: Project Manager, URS Corporation
Phone: (726) 856-5636

Signature: _____ Date: _____

Name: Lech Dolata
Title: Project Manager, NYSDEC
Phone: _____

Signature: _____ Date: _____

Name: Gary Hahn
Title: Laboratory Manager, Ecology & Environment
Phone: (716) 685-8080

Signature: _____ Date: _____

Name: Mary E. Bitka
Title: Quality Assurance Officer, URS Corporation
Phone: (716) 856-5636

Signature: _____ Date: _____

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Figure 1	Organization Chart

LIST OF ATTACHMENTS

Attachment A	Forms
Attachment B	Laboratory QA Manual

A3 DISTRIBUTION LIST

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Ecology & Environment

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Lancaster, New York 14086

URS Project File

URS Corporation – New York

640 Ellicott Street, 3rd Floor

Buffalo, New York 14203

A4 PROJECT AND TASK ORGANIZATION

The project organization and the responsibilities of key personnel are defined below. Figure 1 presents the program lines of authority and generic project organization.

A4.1 Responsibilities

A4.1.1 NYSEG Project Manager

The NYSEG Project Manager is responsible for establishing project scope and objectives and for communicating the same to the contractor. The NYSEG Project Manager is also responsible for identifying internal, regulatory, and procedural requirements pertinent to the work that may differ from accepted industry standards of work. The NYSEG Project Manager for this program is Mr. John J. Ruspantini.

A4.1.2 URS Project Manager

The URS (URS) Project Manager, Jack Wilcox, is responsible for assuring that projects are properly staffed and is ultimately responsible for the technical direction and quality of the work performed by URS personnel. The URS Project Manager is responsible for establishing appropriate budgets and schedules, making available appropriate forms of training, and monitoring the performance of the staff. The Project Manager may talk with regulatory agencies regarding methodologies and requirements. The URS Project Manager is also responsible for monitoring the implementation of the quality assurance program. Specific responsibilities include:

- Assure the provision of necessary facilities, equipment, and funding;
- Review and approve Project Controlling Documents (PCDs) (i.e., Workplan, Quality Assurance (QA) Project Plan (QAPP), and Field Sampling Plan (FSP));
- Support the efforts of the Field Manager, QA Officer (QAO), and Laboratory Manager(s) in all matters concerning the quality of work products; and,
- Assure effective response to corrective action requirements identified by any member of the project team.

A4.1.3 Field Manager

The URS Field Manager Scott McCabe is responsible for the day-to-day management of field operations. The Field Manager schedules and plans the work activities of field staff, provides periodic reports on the progress of work, and reviews the field logs and other forms of field documentation. The Field Manager will work closely with the QAO to plan and schedule audits, if any, assure proper training of field personnel, and immediately communicate any situations that may affect the quality of work products. The Field Manager is responsible for assuring that the work proceeds according to schedule, the FSP, and bears responsibility for guaranteeing the technical quality of the work. Specific responsibilities include:

- Oversee and monitor performance of staff;
- Plan the activities of and coordinate field personnel on specific assignments;
- Provide a liaison between the client, field, laboratory staff, and any other subcontractors;
- Effectively carry out the URS QA Program and this QAPP; and,
- Assure completion of corrective actions, as needed.

A4.1.4 Laboratory QA Manager

The Ecology & Environment, Inc. QA Manager Mr. Gary Hahn is responsible for QA/QC in all aspects of laboratory operations. The Lab QA Officer ensures that laboratory staff uses recognized procedures and accepted laboratory practices. The Lab QA Officer is responsible for

ensuring appropriate instrument maintenance and calibrations. The Lab QA Officer is responsible for method development and documentation of procedures. The Lab QA Officer is responsible for training and designating qualified personnel for laboratory assignments. The Laboratory QA Manager is responsible for assuring compliance with applicable analytical methodology, strict adherence to Standard Operating Procedures (SOPs) and QA/QC requirements. The Lab QA Officer is responsible for ensuring that laboratory analyses proceed according to schedule, and bears responsibility for guaranteeing the technical accuracy and quality of the work. Specific responsibilities include:

- Provide sufficient equipment, space, resources, and personnel to conduct analyses and carry out the laboratory QA programs and this QAPP;
- Ensure appropriate documentation of laboratory methods;
- Ensure that all laboratory records are maintained securely and retrievably;
- Assess the quality of purchased laboratory materials, reagents, and chemicals in relation to their impact on the quality of analytical results; and
- Ensure the implementation of appropriate corrective action for any QA/QC deficiencies identified.

A4.1.5 URS Quality Assurance Officer

The QA Officer (QAO), Mary E. Bitka, or designee, is responsible for implementation of both the URS QA Manual (incorporated by reference) and this QAPP in both field and laboratory operations. The Project Manager delegates to the QAO the authority to take any actions necessary to ensure the reliability and validity of work and deliverables according to this QAPP. The QAO has, by definition, a level of authority coequal to that of the Field Manager and Laboratory QA Manager. The QAO is responsible for developing and implementing procedures to appropriately document all project activities, to provide specific means of measuring conformance to specifications, managing the corrective actions program, and providing periodic reports to management. Specific responsibilities include:

- Develop, document, and carry out QA activities to ensure that appropriate QC measures are being carried out and documented;
- Ensure all records related to quality assurance are documented and maintained securely and retrievably;
- Conduct periodic performance audits and/or surveillance to measure conformance to specifications;
- Prepare periodic quality reports and QA sections of final reports;
- Ensure corrective actions are carried out and documented in a way that precludes future occurrences;
- Review and approve SOPs as provided in the FSP, training records, and purchasing actions; and,
- Acquire and maintain required certifications, and manage performance evaluation tests.

A4.1.6 Technicians and Analysts

Field staff and analysts are responsible for executing their work assignments in strict conformance to documented procedures and for the immediate identification of any conditions adverse to the quality performance of the work or work products. They are responsible for acquainting themselves with the technical requirements of any work assigned and seeking training or guidance as necessary to comply with those requirements. They are responsible for documenting their activities according to applicable SOPs and reviewing their own work and the work of others presented to them for peer review. They will immediately cause work to cease on any activity that in their judgement does not meet applicable quality and safety standards, will appropriately document and report such conditions to management and will be active in the resolution of any such conditions. Specific responsibilities include the following:

- Ensure that all work is performed according to the applicable specifications;
- Ensure that QC measures are being carried out and documented;
- Ensure the quality of work and work products; and,
- Communicate QA and safety concerns to management.

A4.2 Organization

Figure 1 presents the organization chart for this project.

A5 PROBLEM DEFINITION/BACKGROUND

Problem definition and background information about the site are provided in Sections 1.0 and 2.0 of the *SRI Workplan*.

A6 PROJECT/TASK DESCRIPTION

Table 1 provides a tabular summary of the sampling and analysis program. Definition of the major tasks and approach to the work are provided in Section 3.0 and 4.0 of the *SRI Workplan*.

Quality assessment provisions are described in detail in Sections C and D of this document. The schedule for the fieldwork is defined in Section 5.0 of the *SRI Workplan*. Records and reporting are covered in Section A9 of this document and the applicable methods of work and field SOPs are presented in the FSP.

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall objective is to carry out procedures for sample collection, analysis, evaluation, and reporting that will meet the objectives for the program as established by the client in association with the project team. QA objectives will be achieved through the implementation of specific procedures for sampling, field data collection, chain-of-custody, laboratory analysis, calibration, internal quality control, audits, preventive maintenance and corrective actions as described in this QAPP. Table 2 presents QC criteria for measurement data (Data Quality Indicators (DQIs)). Sampling and analytical methodologies are chosen based on the intended use and data quality requirements of the work. The purpose of this section is to define minimum QA goals for precision, accuracy, representativeness, completeness, comparability, and sensitivity in field and laboratory measurements. More specific information regarding data quality indicators, including matrix specific QC criteria and detection limits for individual analytes are presented in the Laboratory QA Manual and/or SOPs in the FSP for the methods of analysis specified in Table 1 and Attachment B.

A7.1 Data Use

As previously established, the intended uses of the data collected as part of this project are varied and are broadly intended for purposes of the evaluation of alternatives and, in later phases of the work, risk analysis. During the first phase of the work sampling will be confined to areas expected to be highly contaminated with the expectations that concentrations of analyte will far exceed any anticipated regulatory comparison criteria. Thus, this plan supposes that data and data deliverables from the first round will be treated in a less rigorous way than data from subsequent rounds. For example, in the sections on analytical data reporting and data validation, different deliverable requirements are specified for the first round than for subsequent rounds and a lesser form of data review proposed for the first round compared to the more comprehensive validation anticipated for subsequent rounds of sampling and analysis.

There are two levels of data quality that encompass all of the various measurements.

A7.1.1 Definitive

Definitive data are quantitative and provide confirmation of analyte identification on an analyte specific basis. They are usually generated using published analytical methods. These data include full laboratory deliverables (i.e., CLP-like) with detailed QA/QC information provided in addition to detailed sample specific information, allowing for independent review. Soil, sediment, sludge, groundwater, surface water, and waste chemical analysis measurements will be defined as definitive in nature.

A7.1.2 Screening

Screening level data are generally developed using less rigorous analytical methods. The data may provide indications of contamination, be semi-quantitative, and may not be analyte specific. To be considered data of known quality, screening level measurements must be confirmed by definitive methods. For purposes of this program monitoring well purging parameters are considered to be screening measurements.

A7.2 QA Objectives for Measurement

A7.2.1 Accuracy

Accuracy means agreement between a known value and a measured value. This is normally expressed as percent recovery (%R) of a surrogate, matrix spike, and/or analytical control sample.

$$\%R \text{ Accuracy} = \left(\frac{\text{Measured Value}}{\text{Known Value}} \right) \times 100\%$$

Equation 1

The accuracy objectives are noted in Table 2. The Laboratory Manager will be responsible for compliance with accuracy objectives. Should any of the data fail the accuracy criteria, corrective action will be taken as described in the method, the relevant SOPs, or according to the provisions of Section C1. Peer and senior review of work products will be provided as a check on measurement accuracy.

A7.2.2 Precision

Precision is agreement among individual measurements of the same property under similar conditions. Precision is tested through the use of field and laboratory duplicate or replicate analyses. It is usually expressed as either relative percent difference (RPD) or percent relative standard deviation (%RSD) between duplicates or replicates.

$$\%RPD = \left(\frac{|Rep1 - Rep2|}{(Rep1 + Rep2)/2} \right) \times 100\%$$

Equation 2

$$\%RSD = \left(\frac{\sigma_{x_1 \dots x_n}}{\bar{X}_{x_1 \dots x_n}} \right) \times 100\%$$

Equation 3

The precision objectives are noted in Table 2. The Laboratory Manager will be responsible for compliance with precision objectives. Should any of the data fail the precision criteria, corrective action will be taken as described in the method, the relevant SOPs, or according to the provisions of Section C1. Peer and senior review of work products will be provided as a check on laboratory precision.

A7.2.3 Representativeness

Representativeness is a measure of the degree to which the measured values accurately and precisely reflect the medium being sampled. Representativeness is largely the result of the appropriate selection of sampling locations and sampling methods. It is assessed through the comparison of field duplicate sample data to the original sample data and the review of blanks. Should any of the data fail the representativeness criteria, corrective action will be taken as described in the method, the relevant SOPs, or according to the provisions of Section C1. Peer and senior review of work products will be provided as a check on laboratory representativeness. The QAO is responsible for assessing representativeness of the data and implementing corrective actions according to the provisions of Section C1.

A7.2.4 Completeness:

Completeness is a measure of the amount of valid data obtained compared to the amount of valid data expected to be obtained under normal conditions.

$$\% \text{ Completeness} = \frac{\text{Quantity of Reliable Data}}{\text{Total Quantity of Data}} \times 100\%$$

Equation 4

The completeness objectives are as noted in Table 2. The QAO will be responsible for monitoring the completeness objectives. Should any of the data fail the completeness criteria, corrective actions will be taken, which may include re-sampling and/or reanalysis.

A7.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another. Comparability will be controlled by following the FSP that was developed to standardize the collection of samples and acquisition of measurements. Consistent, proper calibration of all equipment throughout the field exercises, as described in this QAPP, will help in maintaining the comparability of measurements. Field documentation and QA audits will be used to establish that protocols for sampling and measurement follow the FSP.

A7.2.6 Sensitivity

Sensitivity is a quantitative statement that conveys the lowest level of measurement that can be distinguished from background with a given level of confidence. Analytical detection limits (sensitivity) should be low enough to confirm the presence or absence of a given analyte at a concentration greater than predetermined comparison criteria, at specified levels of precision and accuracy. Practical quantitation limits (PQLs), which are highly matrix dependent, are presented in Table 2. Specific detection limits are presented in the method SOPs and/or laboratory QA manual. The laboratory QAO is to contact the URS QAO when sample results exceed the project-specific action criteria at the non-detect level.

A8 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

In addition to health and safety training as required for hazardous site workers by the Occupational Safety and Health Administration, field and laboratory personnel will receive technical training in the techniques they are expected to carry out. Training will consist of, at a minimum, on the job training by a senior staff member in the procedures they are expected to implement in accordance with FSP, documented by virtue of a signed copy of the cover sheet for the FSP. Said documentation will be retained on file by the QAO.

Analysts will receive appropriate training in procedures, safety, and waste disposal. The Laboratory QA Manager, or his designee, will train all analysts on analytical methods and operation of laboratory instrumentation. All analysts will be required to prove the ability to execute methods they perform with acceptable precision and accuracy through analysis of performance evaluation samples in quadruplicate, which meet the applicable QC standards of the method. Training completed by the analyst will be documented by the Laboratory QA Manager and maintained on file. These records will serve the additional purpose of providing for validation of non-standard methods of analysis.

A9 DOCUMENTATION AND RECORDS

Bound logbooks will be used for all record keeping purposes both in the field and laboratory with the exception of certain standard forms, which will be maintained in three ring binders. All logbooks and binders will contain a unique document control number. All pages, including loose-leaf forms, will be numbered.

Field and laboratory personnel will transmit the bound logbooks to the Field Manager or Laboratory QA Manager (or their designees) on a routine basis. Original logbooks will be reviewed at a frequency not to exceed once every week, by the Field or Laboratory QA Manager, who will sign the logbook as proof of said review.

All entries must be recorded in ink or other permanent marking device and signed and dated. Correction to entries will be made by drawing a line through the incorrect entry, recording the correct information, and initialing and dating the corrected entry. If the reasons for making the change are not immediately evident, an explanation is required. Unused portions of logbook pages must be lined out.

If computerized information is used, a hard copy that has been permanently affixed to the logbook will be acceptable as an original record of sampling and/or laboratory logging

A9.1 Field Records

Field records, including sample collection records, chain of custody records, etc. will be maintained according to the FSP. At a minimum, all field personnel will keep a personal log of activities, noting any conditions that in their judgement may bear on the use or interpretation of the data they acquire.

A9.2 Laboratory Records

A9.2.1 Laboratory Log In

Once the laboratory has received the samples, they will be logged into the laboratory's Laboratory Information Management System (LIMS) or into a bound laboratory notebook. Minimum information content for log in includes:

- Field sample number;
- Laboratory receipt date;
- Chain of Custody status;
- Condition in which sample arrived (i.e., intact, cracked lids, frozen, etc.);
- Analyses requested;
- Other pertinent observations including temperature, preservation status, appearance, etc.

A9.2.2 Reference Materials

Bound logbooks must be maintained of all reference materials used for analytical purposes. This will include records of all dilutions or other standard preparation steps such that all standards used during analysis will be traceable to purchased certified standards. The record must include the following information:

- Date of receipt;
- Source;
- Purity;
- Unique identification numbers;
- Record of dilutions/preparation referencing original standard ID number; and,
- An expiration date.

A9.2.3 Sample Preparation

Personnel involved in doing sample extraction, digestion or other sample preparation techniques must maintain a record of those activities in a bound logbook. Although this logbook must be specific to the operation, it need not be operator specific. The logbook should be signed and dated daily and contain the following information:

- Samples prepared, including date and time, analysis, weights or volumes involved at beginning and end of process;
- Standards and reagents used;
- QC samples prepared with the batch and the reference values of the standards if applicable;
- Procedures used; and
- Relevant calculations and other relevant observations such as color, foaming, gas generation, etc.

A9.2.4 Instrument Operation

Each instrument must have a dedicated logbook. Information in the logbook must reflect routine and emergency maintenance activities, tuning, calibration, and all analytical activities conducted on the instrument. A new page must be started daily during equipment operation. Information to be included for each page consists of:

- Date, operator, and project name;
- Description of any instrument maintenance or modification;
- Tuning and calibration activities;
- Instrument settings;
- Instrument operating conditions; and
- Samples analyzed including QA/QC samples and the results of each if separate instrument printouts are not provided. The use of automated data acquisition systems will require recording a reference to the data file for each standard or sample.

Hard copy data output from integrators and chromatograms should have the following information on the printout:

- Analysis date and time;
- Test name and sample number;
- Reference to the calibration curve used for quantitation;
- Logbook reference to recorded analytical activities; and
- Identification of chromatographic peaks.

A9.3 Laboratory Deliverables

For the first round of sampling, a summary data reporting format consisting of analytical results and a QC summary will be provided (see Screening Data, below). For all subsequent rounds of sampling and analysis, the required analytical deliverable for definitive data types from the fixed-base laboratory must include the following at a minimum.

Screening Data

Summary reporting only will be provided.

- Narrative and sample cross reference
- Copies of Chain of Custody documents
- Analytical results

QA/QC summary

Definitive Data

The following forms are required for all organics analyses using gas chromatography.

- Narrative and sample identification cross reference
- Copies of Chain-of-Custody documentation

- Organic analysis data summary for field and QC samples
- System monitoring compound/surrogate summary
- QC Check Sample/LCS summary
- Matrix Spike and Duplicate summary
- Method blank summary
- Retention time windows
- Initial Calibration summary
- Continuing calibration summary
- Pesticide Identification summary for Multi-component Analytes
- Raw data for field samples including sample prep and run logs
- MDLs and RLs

The following forms are required for all organics analyses using gas chromatography/mass spectroscopy.

- Narrative and sample identification cross reference
- Copies of Chain-of-Custody documentation
- Organic analysis data summary for field and QC samples
- System monitoring compound/surrogate summary
- QC Check Sample/LCS summary
- Matrix Spike and Duplicate summary
- Method blank summary
- Tune summary
- Initial calibration summary
- Continuing calibration summary
- Raw data for field samples including sample prep and run logs
- MDLs and RLs
- Internal Standard summary

The following forms are required for all metals analyses.

- Narrative and sample identification cross reference
- Copies of Chain-of-Custody documentation
- Inorganic analysis summary
- Initial and continuing calibration summary
- Calibration blank summary
- ICS summary
- Method blank summary
- Matrix spike/PDS summary
- Duplicate summary
- LCS summary
- Serial dilution summary
- Instrument raw data
- Sample preparation and run logs
- Analytical sequence summary

- Definition of IDLs, MDLs, and RLs

The following forms are required for all other analyses.

- Narrative and sample identification cross reference
- Copies of Chain-of-Custody documentation
- Analysis results summary
- Initial and continuing calibration summary
- LCS summary
- Method blank summary
- Sample spike summary (as applicable)
- Duplicate sample summary
- Instrument raw data
- Sample prep and run logs

A9.4 Record Storage and Handling:

All records will be designated as "lifetime" or "nonpermanent" by the project-specific QAOs before temporary or final storage by URS. Nonpermanent records will be retained for three years after the completion of the fieldwork, or three years after the date the record was generated, whichever is longer. A lifetime record will be stored until authorized for destruction by either the client or legal order.

Records of either type will be catalogued before storage at a secure laboratory and URS storage facility. The storage facility will confirm that the received parcels contain all of the catalogued records and convey a receipt for the records to the originating office. The records will be made available to the originating office upon request and according to the procedures of the storage facility.

The QAO will review all records as they are received from various sources (e.g., the client, the laboratory, subcontractors, etc.) and determine whether the records are lifetime or nonpermanent. Lifetime records must meet one or more of the following criteria:

- The record may be of significant value in demonstrating capability for safe operations;
- The record may be of significant value in maintaining, reworking, repairing, replacing or modifying an item, or updating applicable remedial investigation and feasibility studies;
- The record may be of significant value in determining the cause of an accident or malfunction of an item; or,
- The record provides required baseline data for in-service inspections.

Nonpermanent records are those records that do not meet the listed criteria.

B1 SAMPLING PROCESS DESIGN

The sampling process design and rationale are described in the FSP. Project staff are responsible for becoming familiar with the details of that document as they pertain to their assigned work. The detailed schedule for project activities is provided in Section 5.0 of the SRI Workplan.

B2 SAMPLING METHODS REQUIREMENTS

Detailed specifications for sampling procedures are contained in the FSP, including sample locations definition, methods of sampling and sub sampling, equipment, preservation and holding time requirements, and decontamination procedures. Field personnel will be trained to the provisions of those PCDs and are expected to execute the work in strict accordance with those instructions and specifications. In the event that a field change to those specifications is required, said changes will be fully documented in accordance with the provisions of Section C and subject to technical review including an assessment of the impact of the change on the quality and usability of resulting data (see Section D1). The Field Manager will consult with the Project Manager and receive verbal approval of the change in advance to the fullest extent possible but will use his discretion based on professional judgement and experience as required to acquire samples and data suitable to the intended use and objectives of the work.

The fixed-base laboratory will be Ecology & Environment, Inc. in Lancaster, New York. The facility is more fully described in Attachment B Laboratory QA Manual.

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Field personnel will, be aware at all times of the need to maintain all samples, whether in the field or in the laboratory, under strict chain of custody. A sample is in the custody of a person if it is in his possession, within his view, or secured by him in a location accessible only to authorized personnel. Chain of custody provisions as defined in Section 3.0 of the FSP are applicable to all off-site shipments of samples. An example of a typical chain-of-custody form is provided in Attachment A.

Samples received in the laboratory will be received under chain of custody and will be defined as in a secure location while within the confines of the laboratory. Laboratory facilities will be locked whenever personnel are not present. Custody will be terminated by filing manifests and/or shipping documents upon clean disposal.

B3.1 Sample Receipt

Samples delivered to the fixed-base laboratory will be received and processed in accordance with the provisions of the laboratory QA Manual (Attachment B).

B3.2 Laboratory Coordination

The Laboratory Manager or his designee will contact the Field manager each day to verify laboratory receipt of samples sent the previous day and to coordinate sample receipts for the current day. The Laboratory Manager will inform the data user of any problems observed with the previous day's shipment (e.g., breakage, inconsistencies with chain-of-custody and actual numbers received), at which time corrective action will be carried out by agreement between the parties. Said agreement will be documented in the form of a telephone conversation log entry.

B3.3 Sample Holding Times

Sample holding time, (the time between sample collection and sample preparation and/or analysis), in which a sample can be considered valid and representative of the sample matrix, is specific to the analytes of interest and the method of analysis employed. Although holding times will not generally be at issue in a field measurement where samples are to be analyzed on the day of receipt, the allowable holding times for the analyses performed in the off-site laboratory are presented in Table 3. The Laboratory Manager or his designee is responsible for sample tracking and to ensure that holding times are not exceeded.

B4 ANALYTICAL METHOD REQUIREMENTS

B4.1 Analytical Methods

Analytical methodologies will be based on current USEPA methods, other published sources, or on manufacturer's recommendations in the case of certain semi- or non-quantitative measurements. Table 1 presents a listing of the analytical methods applicable to this work and the source of guidance for that method. All analytical methods are documented in SOPs, reviewed and approved by the Laboratory QA Manager or his designee. Specific QC procedures and corrective action requirements are addressed in Section B5.

B4.2 Sample Preparation

Subsampling (i.e., the selection of analytical aliquots) will be performed using standard methods. Except for samples analyzed for VOCs, field submitted samples will be homogenized through gentle agitation (in the case of aqueous samples) prior to selecting the analytical aliquot or through a cone and quartering technique for soils. Care must be taken with VOC samples to minimize losses through volatilization during aliquot selection (i.e., minimizing agitation, splashing, etc.) and to select solid sample aliquots from previously unexposed surfaces.

Sample preparation will be performed according to SOPs based on standard methods or manufacturer's recommendations. For the fixed-base laboratory, details are provided in Attachment B Laboratory QA manual. In the field laboratory, preference will be given to methods that require minimum space, provide for rapid processing, and produce minimal amounts of waste. All sample preparations will be performed with appropriate personnel protective devices immediately available. The use of heat sources will be limited to the fullest extent possible and no open flame or sparking apparatus will be employed. Sample preparation will be documented according to the provisions of Attachment B (laboratory QA Manual) including documentation of all standards and reagents employed, the known values of all standard and spiking mixtures employed with cross references to appropriate dilution log entries, and notation of any pertinent observations by the analyst.

B4.3 Reference Materials

Reference standards are required to generate certification data, calibrate instruments, spike analytical surrogates or standards, and prepare QC samples. These solutions must be of known concentration and purity to be useful in assessing the quality of analytical data.

Standards used to conduct analyses will be either Standard Analytical Reference Materials (SARMs), Interim Reference Materials (IRMs), or purchased, certified standards. SARMs developed and distributed by the Central QA Laboratory of the National Institute of Standards and Technical (NIST) will be the preferred standard. IRMs are not as rigorously characterized as

SARMs. In any case where standards other than those described above are employed, or where the analytical method so specifies, second source verification of standards will be required.

Material safety data sheets (MSDSs) for all standards and reagents will be stored on-site. It is the responsibility of the Laboratory Manager and all personnel to know where MSDSs are stored and to be familiar with the content of the most commonly used chemicals in the laboratory environment.

Reference materials for organic analyses must be stored in a refrigerator at or below 6 C. When purchased standards are used to create stock standards and subsequent dilutions for calibration and spiking, the standards log must be filled out by the analyst according to the provisions of Section A10. Newly created standards will be labeled with a unique identification number, the analyte(s), concentrations, date created, and an expiration date. Newly created standards will be analyzed against existing standards and are expected to agree to within method accuracy requirements. If this test fails, the analyst must investigate the problem to identify which standard is deficient. If the new standard is deficient, the entry in the standards log will be voided and new standard prepared. If the old standard appears to have degraded, the Laboratory Manager is to be notified to assess the impact to the quality of related analyses. Corrective action will be followed and documented in accordance with the provisions of Section C.

B4.4 Waste Disposal

All generated wastes will be properly segregated and stored in properly labeled containers. Field generated waste will be handled according to the provisions of the site-specific work plan and FSP. In the laboratory, analyses will be conducted in a way that keeps wastes to a minimum. It will be the responsibility of the site owner to properly dispose of all field and field laboratory generated wastes.

B4.5 Decontamination

Decontamination of field equipment will be accomplished according to the site specific FSP. In general terms, decontamination will be performed on all equipment that will contact the sampled media before the start of work and between sampling locations. Decontamination will generally consist of a non-phosphate detergent and water wash followed by a series of rinses with tap water, deionized water, and air-drying. Equipment is stored in clean areas, wrapped in plastic or aluminum foil sheeting.

Drilling tools will be steam cleaned between sampling locations. If steam cleaning does not remove coal tar from the drilling tools or other equipment, then a biodegradable degreaser such as CitruSolv® will be sprayed on the tools and a scrub brush will be used to help breakdown the coal tar. If CitruSolv® alone is ineffective, diesel fuel may be utilized followed by CitruSolv®. In any case, any solvent wash(es) employed will be followed by steam cleaning, with the final rinse deionized water.

Disposable lab ware will be employed to the fullest extent possible. Laboratory supplies and equipment that are reused will be decontaminated using soap and water washes followed by repetitive rinses with demonstrated analyte free water and appropriate solvents. The cleanliness of lab ware and equipment will be shown by using method blanks.

B5 QUALITY CONTROL REQUIREMENTS

Field programs will include the collection and analysis of appropriate types of quality control samples. For purposes of this program the following field QC samples will be used: field duplicates, rinse/equipment blanks, and trip blanks. Matrix spike/matrix spike duplicate samples are required by the methods of analysis proposed and additional field sample will be provided to the laboratory for this purpose as required. This section describes the method of collection and typical frequency of collection for field quality control samples. In addition, laboratory QC samples are also analyzed to establish the precision, accuracy, and representativeness of results. This section also describes the QC samples associated with each type of analysis, the acceptance criteria for each QC check, and the corrective actions taken if criteria are not met.

B5.1 Field QC Samples

Duplicate samples will generally be taken from areas known or suspected to be contaminated at a frequency equal to 5% of all field samples. When appropriate to this method, matrix spike/matrix spike duplicates will also be collected at a frequency of 5% each. Soil sample duplicates are collected and homogenized before being split. Field duplicates for water samples will be collected at the same time. Samples submitted for VOC analyses are not homogenized. Soils VOC analyses must be sealed immediately and shipped to the laboratory. Field duplicate results must be assessed by the data user. No corrective action is taken in the laboratory based on field duplicate results.

Rinse/equipment blanks will be collected when the sampling equipment is decontaminated and reused in the field or when a sample collection vessel (bailer or beaker) will be used, at a frequency of one per twenty samples (5%). The equipment used in sampling will be rinsed with analyte free water and the water running off the equipment will be collected in sample containers.

Trip blanks will be provided by the laboratory and will consist of analyte free water. The trip blank must be carried into the field with the sampling containers and will accompany the samples to the laboratory for volatile organic compound analysis. One trip blank will be submitted per day of sampling.

Submitted field blank results will be assessed by the data user. No corrective actions are taken by the laboratory based on field submitted blanks.

B5.2 Laboratory QC Samples

Table 4 presents the QC samples analyzed with each method, the frequency at which those QC checks are made, the acceptance criteria applied, and the corrective action taken if acceptance criteria are not met.

QC data are maintained for periodic review by the QAO. The QAO, as a part of their periodic report to the Project Manager, will identify any areas of concern for formal corrective action according to the provisions of Section C1.

B5.3 Audits/Surveillances

This section discusses performance and system audits/surveillances used to monitor the capability and performance of the total measurement system and to evaluate the quality of field and laboratory operations. A performance audit is a planned independent check of the operation of a system to obtain a measure of the quality of data generated. It involves the use of standard reference samples or materials certified as to their chemical composition or physical characteristics. System audits are of a qualitative nature and consist of on-site review of a system's quality assurance system and physical facilities for sampling/analysis, calibration, and measurement. Less formal surveillance may also be executed to assess conformance of field and laboratory staff to work specifications. The QAO will be responsible for auditing field activities and the field analytical laboratories at a frequency agreed upon with the Project or Laboratory Manager.

B5.3.1 Field System Audits

If authorized by the client, a field QA audit will be conducted during the first few days of each major field activity to learn if the field teams are following protocols delineated in the PCDs. The QAO will assess conformance to the following general provisions using a check list based on site specific PCDs:

- Copies of the Health and Safety Plan, Field Sampling, and QAPP are on-site and accessible to the sampling and analysis teams;
- The field instruments are of the proper type, have been properly maintained and calibrated;
- Appropriate documentation is maintained according to agreed upon specifications;
- Sample collection and analysis procedures are executed per the QAPP and Workplan or FSP; Sample handling procedures are executed properly;
- Chain-of-custody forms include all information listed in the SOP, and;
- Sampling equipment is properly decontaminated per the QAPP and FSP.

During the audit, appropriate actions will be taken by the QAO to ensure that field sampling is conducted according to this QAPP and the Workplan or FSP. The QAO will document any deficiencies encountered during the audit and any actions taken in the field to correct potential problems. Results of the audit will be maintained at the URS office in Baltimore, MD, as part of the QA documentation.

Upon completion of the audit, a report of the findings will be given to the Project Manager. Deficiencies encountered will be listed in the report and the corrective action recommended/taken to rectify the problem.

B5.3.2 Laboratory System Audits

The URS QAO may perform laboratory audits to assess compliance with the provisions of this QAPP. In the event that such an audit is authorized by the client, the QA manager will inspect the laboratory's facilities to verify the adequacy and maintenance of instrumentation and the conformance of personnel to SOPs. The items to be checked include, but are not necessarily limited to:

- Size and appearance of the facility;

- Quantity, age, availability, scheduled maintenance and performance of instrumentation;
- Availability, appropriateness, and use of SOPs including QC provisions;
- Staff qualifications, experience, and personnel training programs;
- Reagents, standards, and sample storage facilities;
- Standard preparation logbooks and raw data;
- Bench sheets and analytical logbook maintenance and review; and
- Review of the laboratory's sample analysis/data package inspection procedures.
- Ensuring that all records, logs, SOPs, and analytical results are maintained securely and retrievably.

Upon completion of the laboratory audit, a report of the findings will be given to the Laboratory Manager. Deficiencies encountered will be listed in the report with the corrective action recommended/taken by the laboratory. Deficiencies found during the audit will immediately be relayed to the appropriate laboratory personnel for immediate corrective action.

B5.3.3 Office Audits

The QAO will also conduct audits of the case files. These audits will determine the completeness of the files and verify that all of the appropriate information is included in the files.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

All equipment and supplies purchased in support of these activities will be purchased according to the provisions of this plan, which requires a documented review of the vendor and equipment selection process and receipt inspection and/or testing as appropriate.

In summary, those procedures require that new equipment be tested with an appropriate standard or standards to ensure they function according to their intended use. Quality control sample results from initial field use of all equipment and supplies will be reviewed by the Field Manager, Laboratory Manager or his designee to identify any cause for concern regarding new equipment and supplies received. Corrective actions will be implemented and documented according to the provisions of Section C as required.

Instrument maintenance, both routine and preventive, will be performed according to manufacturers' instructions. A preventive maintenance plan allows for periodic instrumentation checks for problems that occur frequently. The objective of a preventive maintenance plan is to rectify equipment problems before they become serious. Preventive maintenance also brings attention to those areas of the instrument susceptible to degradation from aging, toxic/corrosive attack, and clogging due to environmental factors.

Procedures for preventive maintenance are contained in each instrument's manual under the maintenance/troubleshooting sections. Logbooks, such as those described in Section A10, will be maintained for each instrument used in the laboratory. Maintenance, calibration, and performance data will be entered by the operator and will be periodically reviewed by the Field/Laboratory Manager.

An inventory of critical spare parts will be maintained on-site during all field activities. Critical spare parts are defined as those that would cause a delay in field or laboratory activities of greater

than 4 hours upon failure. The specific needs of the program will be determined at the discretion of the Field/Laboratory Manager.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

An instrument calibration establishes a reproducible reference point to which all sample measurements can be correlated. The analytical method mandates the frequency of instrument calibrations. Laboratory calibration standards will be traceable to their sources. Documentation of all standards used and their preparation will be included in the Standards Log referenced in Section A10.

Routine calibrations are required for most forms of analytical instrumentation. An initial calibration is performed before sample analysis. Where appropriate, retention time windows will be established for each compound of interest. At a minimum, a 3-point calibration curve will be established for quantitative analyses. Single point calibrations will be acceptable for semi-quantitative and qualitative tests. Calibrations will be verified by using independent standards as a QC check sample, calibration verification sample, or fully processed Laboratory Control Samples (LCSs).

For quantitative analyses, a continuing calibration check (midpoint calibration standard) will be analyzed periodically according to the provisions of the applicable SOP. All analytical sequences will end with a calibration verification, although occasionally, where sequential work shifts are employed, the second shift continuing calibration will serve as the end of shift check for the first shift.

All calibrations are documented in the run logs and are stored with the project files after completion of the project. Calibration acceptance criteria and corrective actions can be found in Table 4.

B8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Materials and consumables will be inspected by the Field/Laboratory Manager and/or his representative against the purchase order specifications to verify their fitness for use. See Section B6 for additional detail. All materials received will be properly labeled and recorded on the inventory log for accuracy. An expiration date will be assigned immediately to all standards, reagents, and solvents.

Documentation concerning the quality of materials used on-site will be retained in the central files.

B9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENT)

Significant amounts of historical data may be incorporated into the outcome of this work. These data inputs include records of historical activities (summarized as site background information), historical geotechnical and hydrogeologic data, and historic chemical analysis data for environmental media. The fitness for use of all such data is subject to assessment by project management and relevant technical experts. Historical chemical data in particular will be assessed to ensure precision, accuracy, representativeness, comparability, completeness, and sensitivity are consistent with the objectives of this work. Any historical data deemed by project

management to be critical to the successful outcome of this project will be subject to a level of review equivalent to that described in Section D of this QAPP.

B10 DATA MANAGEMENT

The generalized data flow is as follows:

Field data are collected and recorded in bound field notebooks according to the provisions of the FSP and the PCDs. Sample custody and analysis requests are documented on appropriate forms and forwarded to the laboratory. Custody is accepted at the laboratory and samples are recorded in the receiving log. Sample processing is recorded in sample preparation logs and run logs. Raw data either is generated by instrumentation or recorded by the analyst in the appropriate logs. Data are further reduced according to procedures and formulae defined in relevant SOPs. Data are peer reviewed and a report is produced. The report, including any electronic forms is further reviewed for accuracy and completeness. Reports are forwarded to the data user with copies to central files

Electronic data is derived from automated data acquisition systems such as a GC. This instrument is equipped with software that performs various manipulations, identifications, and calculations of analytical data. Software calculations will be verified manually during the data validation process. Other data generated by laboratory personnel may consist of analytical results recorded by the analyst. This data will be documented in a logbook and may subsequently be entered into one or another form of electronic files. The Field and Laboratory Managers or their designees, as a part of their periodic reviews of logbooks and deliverables, will audit transcriptions to ensure accuracy. Any errors encountered will trigger further auditing until no transcriptions errors are encountered in the audit set, up to and including 100% review.

Raw analytical data that require further reduction to produce usable analytical results will be reduced according to procedures defined in the referenced analytical method or SOP for the activity. After the data have been generated, they are subjected to a three-tiered review process. This review process includes verifying the electronic identifications and calculations performed by the software and the analyst.

The first level of review is performed by the responsible technician/analyst. The technician/analyst verifies that QC acceptance criteria have been met and that instrument operating conditions were appropriate to the analysis performed. The second level of review is performed by a peer who performs a double check of the technician/analyst observations, calculations, and QC criteria. At this point, assuming any anomalies identified by the peer have been reconciled, a preliminary report is assembled. The third level of review is performed by a senior staff member, who performs the same checks on the final report. The QAO will also perform reviews of work products as part of his audits.

Data are reported in three forms, two hardcopy forms and one electronic form, depending upon the data user's requirements. Screening level data are generally reported in summary form including sample identification information, results for the sample analyses, and a summary of the QC data including calibrations and verifications of precision, accuracy, and representativeness where appropriate. Definitive level data reports will include all of the above with hard copies of all supporting information, including copies of instrument printouts and all log pages pertaining to the work. For purposes of this program a laboratory deliverable

equivalent to a USEPA Level II will be required of the fixed-base laboratory. Electronic deliverables are required. They will be presented in a flat, fixed field width, ASCII format.

Analytical results will include statements of sensitivity for nondetects whenever applicable. Whether delivered in "Screening" or "Definitive" data packages, all case files will contain copies of or references to all relevant raw and processed data. However, as with bound log books, these data may not be replicated in each case file.

If data manipulation or reduction is performed electronically, outside of the raw data produced by purchased instrumentation, the formulae or macros employed for these purposes will be validated by comparing the results of a sample manual calculation to the result produced electronically. This validation will be documented and maintained in central files.

Additional detail regarding data review and validation is provided in Section D1. Data transformations, to the extent that they are applicable to this work, are detailed in the referenced analytical methods and SOPs. Data analysis techniques applicable to the data will be taken from two sources: (1) Guidance for Data Quality Assessment, EPA QA/G-9, July 1996; and, (2) Guidance for Data Usability in Risk Assessment, Final, April 1992. As applies to this program, data tracking will be performed by the laboratory LIMS. Data storage and retrieval are addressed in Section A9.

C1 ASSESSMENTS AND RESPONSE ACTIONS

Assessment of work and data quality are provided by several means. First, peer and senior review of work and work products are required by this plan at various stages. Second, individual procedures contain detailed QC requirements, acceptance criteria, and corrective action requirements. Third, periodic, independent auditing is stipulated as a part of this plan. Fourth, formal pre-qualification of subcontractors is required by this plan. Corrective action will be initiated where indicated based on the above referenced assessment actions.

To enhance the timeliness of corrective action and reduce the generation of unacceptable measurement data, problems identified by assessment procedures will be resolved at the lowest possible management level. Problems that cannot be resolved at this level will be reported to the QA Manager for resolution. The QA Manager will determine at which management level the problem can best be resolved, and will notify the appropriate manager. Periodic progress reports will detail all problems and subsequent resolutions.

The steps comprising this closed-loop corrective action system include:

- Defining the problem;
- Assigning responsibility for problem investigation;
- Investigating and determining the cause of the problem;
- Assigning responsibility for problem resolution; and
- Verifying that the resolution has corrected the problem.

Documentation of the condition requiring corrective action, assignment of responsibility for corrective action, due dates for completion of corrective action, and verification of completion will be maintained. Such documentation will be reviewed during system audits. A form for use by all project staff to document the identification and resolution of all corrective actions and field changes is included in Attachment A.

Process changes, including field changes, will be governed by control measures commensurate with those applied to the original sampling design. Field changes will be justified, documented and approved by the Project or Laboratory Manager or his designee. The control of changes to project work plans will be according to this requirement.

C2 REPORTS TO MANAGEMENT

The QAO will provide periodic reports to the Project Manager including an overview of activities assessed, identifying any conditions adverse to quality, and stipulating corrective actions carried out and/or required. These reports will be provided at a frequency not to exceed once per quarter and will include as attachments, and as appropriate to the reporting period:

- Data validation findings;
- Audit/surveillance reports;
- Monthly status reports of QC activities;
- Corrective Action Requests and Resolutions; and,
- Other forms of control measurement documentation.

D1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Upon completion of the data collection activities, the QAO will perform a review of the data collected and produce a report for the Project Manager addressing the following:

Sampling design - What, if any, deviations were observed from the PCDs in terms of numbers of samples collected, locations of sample collection points, and unexpected events or observations in the field. An assessment will be provided of the impact of any such deviations on the usability or interpretation of the results.

Sampling procedures - What, if any, deviations were observed from the PCDs in terms of the method of work applied in the collection of the samples. An assessment will be provided of the impact of any such deviations on the usability or interpretation of the results.

Sample handling - What, if any, deviations were observed from the PCDs in terms of the handling and custody of the samples, including containers, preservation, storage, etc. This will include an assessment of any potential sample alias problems. An assessment will be provided of the impact of any such deviations on the usability or interpretation of the results.

Analytical procedures - What, if any, deviations were observed from the PCDs in terms of the method of work applied in the analysis of the samples. An assessment will be provided of the impact of any such deviations on the usability or interpretation of the results.

Quality control and calibration- What, if any, deviations were observed from the PCDs in terms of conformance to QC and calibration criteria. An assessment will be provided of the impact of any such deviations on the usability or interpretation of the results. This assessment will be provided in the form of data validation reports as defined in Section D2.

Data Reduction and processing - What, if any, deviations were observed from the PCDs in terms of data reduction and processing specifications. An assessment will be provided of the impact of any such deviations on the usability or interpretation of the results.

D2 VALIDATION AND VERIFICATION METHODS

Definitive data will be validated according to protocols defined in the USEPA Region II Contract Laboratory Program and SW-846 Data Validation Guidelines for Organic and Inorganic Analyses as modified for the methods of analysis employed and limited to a review of summary forms for assessment of holding times, blanks, spikes, and duplicates. No review will be performed of raw data or of calibrations. A checklist/notes based on the method/protocol is filled out by an independent reviewer to document the observations of the reviewer. To the fullest extent possible the validator will work with the laboratory to resolve any anomalies encountered. The validator then applies data qualifying flags to the data summaries provided by the laboratory and completes a report on each laboratory report consisting of a summary of the findings, copies of data summaries with data qualifying flags applied (if any), a copy of the data validation checklist, and supporting documentation.

For definitive analytical data and for screening data, an independent review of data packages will be performed to ensure compliance with specified analytical, QC, and data reduction procedures;

data reporting requirements; and required accuracy, precision, and completeness measures. At a minimum the following items will be reviewed to validate the data when applicable:

- Sample custody documents;
- QC data summaries; and
- Reasonableness of analytical results.

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The QAO in association with the Project Manager will provide an assessment of the conformance of data gathered in the course of these activities to objectives of the work. Because the data are not intended to be compared to fixed regulatory standards for purposes of assessing compliance formal, numeric DQOs have not been established. Nonetheless, the data must be suitable for use in assessing the nature and extent of environmental impacts; assessing the risks associated with any such impacts; and as inputs to engineering decisions and designs. Thus data which are found during the verification and validation processes to be unsuitable for use (i.e., data impacted by unacceptable deviations from plans and protocols and data found to be qualified as unreliable during the validation process) will be clearly identified and excluded from use in downstream decision-making. If, in the judgement of the Project Manager and the technical data users, insufficient data remain for purposes of the work, additional sample collection and analysis may be performed. Data description and assessment tools as described in EPA QA/G-9, *Guidance for Data Quality Assessment*, may be employed in the course of this reconciliation.

REFERENCES

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Standard Operating Procedure for the Validation of Organic Data Acquired using SW-846 Method 8082, USEPA Region II SOP No. HW-23B, Revision 1, May 2002.

Data Validation Guidelines for CLP Statement of Work (SOW) OLM04.2, USEPA Region II SOP No. HW-6, Revision 12, March 2001.

Evaluation of Metals Data for the CLP based on SOW 3/90, USEPA Region II SOP Revision XI, January 1992.

TCLP Data Validation, USEPA Region II SOP No. HW-7, Revision 3, March 1993.

TABLE 1
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

**NYSEG - AUBURN
FORMER MGP SITE**

Analytical Method ¹	Matrix ¹	No. of Field Samples	Field Duplicates ²	Equipment Blanks ²	Trip Blanks ³	MS/MSD (Pairs) ²	Total No. of Samples
Task 1: Soil Borings and Soil Sampling							
BTEX (USEPA Method 8260B)	Soil	35	2	2	0	2	43
TCL SVOCs (USEPA Method 8270C)	Soil	38	2	2	0	2	46
Fingerprint/PAHs (Modified USEPA Methods 8100/8270C)	Soil	3	0	0	0	0	3
TCL PCBs (USEPA Method 8082)	Soil	35	2	2	0	2	43
Total Phenols (USEPA Method 9065)	Soil	35	2	2	0	2	43
Metals (USEPA Method 6010B/7471A/7470A)	Soil	38	2	2	0	2	46
Total Cyanide (USEPA Method 9012A)	Soil	38	2	2	0	2	46
Free Cyanide (USEPA Method 9012A) ⁴	Soil	4	1	1	0	1	8
Ferrous and Ferric Cyanides ^{4,5}	Soil	4	1	1	0	1	8
Total Organic Carbon (Lloyd Kahn)	Soil	9	1	0	0	1	12
Natural Oxidant Demand (NOD)	Soil	9	1	0	0	1	12
Reactivity (SW-846, Ch. 7, Sec. 3)	Soil	3	0	0	0	0	3
Total Sulfur (ASTM D129-64)	Soil	3	0	0	0	0	3
TCLP Benzene (USEPA Method 1311/8260B)	Soil	3	0	0	0	0	3
Task 2: Monitoring Well Installation							
BTEX (USEPA Method 8260B)	Soil	6	1	1	0	1	10
TCL SVOCs (USEPA Method 8270C)	Soil	6	1	1	0	1	10
Fingerprint/PAHs (Modified USEPA Methods 8100/8270C)	Soil	1	0	0	0	0	1
TCL PCBs (USEPA Method 8082)	Soil	6	1	1	0	1	10
Total Phenols (USEPA Method 9065)	Soil	6	1	1	0	1	10
Metals (USEPA Method 6010B/7471A/7470A)	Soil	6	1	1	0	1	10
Total Cyanide (USEPA Method 9012A)	Soil	6	1	1	0	1	10
Free Cyanide (USEPA Method 9012A) ⁴	Soil	0	0	0	0	0	0
Ferrous and Ferric Cyanides ^{4,5}	Soil	0	0	0	0	0	0
Total Organic Carbon (Lloyd Kahn)	Soil	1	1	0	0	1	4
Natural Oxidant Demand (NOD)	Soil	1	1	0	0	1	4
Reactivity (SW-846, Ch. 7, Sec. 3)	Soil	1	0	0	0	0	1
Total Sulfur (ASTM D129-64)	Soil	1	0	0	0	0	1
TCLP Benzene (USEPA Method 1311/8260B)	Soil	1	0	0	0	0	1

TABLE 1
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

**NYSEG - AUBURN
FORMER MGP SITE**

Analytical Method ¹	Matrix ¹	No. of Field Samples	Field Duplicates ²	Equipment Blanks ²	Trip Blanks ³	MS/MSD (Pairs) ²	Total No. of Samples
Task 3: Groundwater Sampling							
BTEX (USEPA Method 8260B)	GW	12	1	1	3	1	19
TCL SVOCs (USEPA Method 8270C)	GW	12	1	1	0	1	16
PAHs (Modified Method 8270C)	GW	2	1	1	0	1	6
TCL PCBs (USEPA Method 8082)	GW	12	1	1	0	1	16
Total Phenols (USEPA Method 9065)	GW	12	1	1	0	1	16
Metals (USEPA Method 6010B/7471A/7470A)	GW	12	1	1	0	1	16
Total Cyanide (USEPA Method 9012A)	GW	12	1	1	0	1	16
Free Cyanide (USEPA Method 9012A) ⁴	GW	3	1	1	0	1	7
Ferrous and Ferric Cyanides ^{4,5}	GW	3	1	1	0	1	7
Alkalinity (USEPA Method 310.1)	GW	12	1	1	0	1	16
Chloride (USEPA Method 300.0)	GW	12	1	1	0	1	16
Nitrate/nitrite (USEPA Method 300.0)	GW	12	1	1	0	1	16
Sulfate/Sulfide (USEPA Method 300.0/376.2)	GW	12	1	1	0	1	16
Dissolved Iron (USEPA Method 6010B) - Field Filtered	GW	12	1	1	0	1	16
Ferrous Iron (Field Analysis)	GW	12	1	1	0	1	16
Total Dissolved Solids (USEPA 160.1)	GW	12	1	1	0	1	16
Task 4: Test Trenches							
BTEX (USEPA Method 8260B)	Soil	7	1	1	0	1	11
TCL SVOCs (USEPA Method 8270C)	Soil	7	1	1	0	1	11
Fingerprint/PAHs (Modified USEPA Methods 8100/8270C)	Soil	2	0	0	0	0	2
TCL PCBs (USEPA Method 8082)	Soil	7	1	1	0	1	11
Total Phenols (USEPA Method 9065)	Soil	7	1	1	0	1	11
Metals (USEPA Method 6010B/7471A/7470A)	Soil	7	1	1	0	1	11
Total Cyanide (USEPA Method 9012A)	Soil	7	1	1	0	1	11
Free Cyanide (USEPA Method 9012A) ⁴	Soil	2	0	0	0	0	2
Ferrous and Ferric Cyanides ^{4,5}	Soil	2	0	0	0	0	2
Total Organic Carbon (Lloyd Kahn)	Soil	7	1	0	0	1	10
Natural Oxidant Demand (NOD)	Soil	7	1	0	0	1	10
Reactivity (SW-846, Ch. 7, Sec. 3)	Soil	1	0	0	0	0	1
Total Sulfur (ASTM D129-64)	Soil	1	0	0	0	0	1
TCLP Benzene (USEPA Method 1311/8260B)	Soil	1	0	0	0	0	1

TABLE 1
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

**NYSEG - AUBURN
FORMER MGP SITE**

Analytical Method ¹	Matrix ¹	No. of Field Samples	Field Duplicates ²	Equipment Blanks ²	Trip Blanks ³	MS/MSD (Pairs) ²	Total No. of Samples
Task 5: Surface Water and Sediment Samples (Minimum number of samples indicated)							
TCL VOCs (USEPA Method 8260B)	SW	5	1	1	1	1	10
TCL SVOCs (USEPA Method 8270C)	SW	5	1	1	0	1	9
PAHs (Modified Method 8270C)	SW	1	1	1	0	1	5
TCL PCBs (USEPA Method 8082)	SW	5	1	1	0	1	9
Total Phenols (USEPA Method 9065)	SW	5	1	1	0	1	9
Metals (USEPA Method 6010B/7471A/7470A)	SW	5	1	1	0	1	9
Total Cyanide (USEPA Method 9012A)	SW	5	1	1	0	1	9
Free Cyanide (USEPA Method 9012A) ⁴	SW	1	1	1	0	1	5
Ferrous and Ferric Cyanides ^{4,5}	SW	1	1	1	0	1	5
BTEX (USEPA Method 8260B)	Sed	12	1	1	0	1	16
TCL SVOCs (USEPA Method 8270C)	Sed	12	1	1	0	1	16
Fingerprint/PAHs (Modified USEPA Methods 8100/8270C)	Sed	3	0	0	0	0	3
TCL PCBs (USEPA Method 8082)	Sed	12	1	1	0	1	16
Total Phenols (USEPA Method 9065)	Sed	12	1	1	0	1	16
TAL Metals (USEPA Method 6010B/7471A/7470A)	Sed	12	1	1	0	1	16
Total Cyanide (USEPA Method 9012A)	Sed	12	1	1	0	1	16
Free Cyanide (USEPA Method 9012A) ^{4,5}	Sed	3	1	1	0	1	7
Ferrous and Ferric Cyanides ³	Sed	3	1	1	0	1	7
Total Organic Carbon (Lloyd Kahn)	Sed	12	1	0	0	1	15

1. GW - groundwater, Sed - sediment, SW - surface water
BTEX - Benzene, toluene, ethylbenzene, and xylenes
PAHs - Polycyclic aromatic hydrocarbons

Metals - Al, Sb, As, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Pb, Mg, Ni, Mn, Hg, K, Na, Se, Th, Ag, Vn, and Zn using USEPA SW-846 Methods 6010B, 7470A, and 7471A
Dissolved Iron (Field Filtered) using USEPA SW-846 Method 6010B

AVS-SEM - Acid Volatile Sulfide/Simultaneously Extracted Metals using USEPA SW-846 6010

2. Assumes a 5% frequency (one per 20 field samples)

3. Approximate - Assumes one per day of field sampling for water samples only.

4. Will be analyzed as needed if total cyanide concentration exceeds applicable regulatory criteria.

5. Cyanide speciation by ion chromatography.

TABLE 2
QUALITY CONTROL CRITERIA FOR MEASUREMENT DATA

**NYSEG - AUBURN
FORMER MGP SITE**

Screening Level Data				
Test Type ¹	Precision ^{2,14}	Accuracy ^{3,15}	Representativeness ⁴	Completeness ⁵ Sensitivity ⁷
Field pH	N/A - continuous read	Cal. Ver. ± 0.1 S.U.	N/A	100% S.U.
Field Temperature	N/A - continuous read	Cal. Ver ± 0.5 C (annual)	N/A	100% C
Field Conductivity	N/A - continuous read	Cal. Ver ±10%	N/A	100% ohms
PAH Fingerprint	N/A	N/A	N/A	N/A

Definitive Level Data (Soil)				
Test Type ¹	Precision ^{2,14}	Accuracy ^{3,15}	Representativeness ⁴	Completeness ⁵ Sensitivity (PQL) ⁶
TCL VOCs/BTEX	See Attachment B	See Attachment B	Blank < DL8	95% ppb ¹²
TCL SVOCs/PAHs	See Attachment B	See Attachment B	Blank < DL8	95% ppb ¹²
Total Phenol	RPD < 35%	75% < %R < 125%	Blank < DL8	95% ppm ¹⁰
Total Cyanide	RPD < 35%	75% < %R < 125%	Blank < DL8	95% ppm ¹⁰
PCBs	See Attachment B	See Attachment B	Blank < DL8	95% ppb ¹²
TOC	RPD < 35%	75% < %R < 125%	Blank < DL8	95% ppm ¹⁰
Total Metals	RPD < 35%	75% < %R < 125%	Blank < DL8	95% ppm ¹⁰

Definitive Level Data (Water)				
Test Type ¹	Precision ^{2,14}	Accuracy ^{3,15}	Representativeness ⁴	Completeness ⁵ Sensitivity (PQL) ⁶
TCL VOCs/BTEX	See Attachment B	See Attachment B	Blank < DL8	95% ppb ¹²
TCL SVOCs/PAHs	See Attachment B	See Attachment B	Blank < DL8	95% ppb ¹²
Total/Dissolved Metals	RPD < 20%	75% < %R < 125%	Blank < DL8	95% ppb ¹²
Total Cyanide	RPD < 20%	75% < %R < 125%	Blank < DL8	95% ppm ¹⁰
Alkalinity	RPD < 20%	75% < %R < 125%	Blank < DL8	95%
Chloride	RPD < 20%	75% < %R < 125%	Blank < DL8	95%

TABLE 2
QUALITY CONTROL CRITERIA FOR MEASUREMENT DATA

**NYSEG - AUBURN
FORMER MGP SITE**

Nitrate/Nitrite	RPD < 20%	75% < %R < 125%	Blank < DL8	95%	
Sulfate/Sulfite	RPD < 20%	75% < %R < 125%	Blank < DL8	95%	
TOC	RPD < 20%	75% < %R < 125%	Blank < DL8	95%	ppm ¹⁰

- (1) All specifications in these tables refer to the minimum data quality goals for the default method of analysis. Defaults are presented in Table B4-I. Laboratory specific and matrix specific quality control criteria are presented in the method SOP or QA Manual for the laboratory (Attachment B).
- (2) Precision as assessed as the RPD of duplicate control samples.
- (3) Accuracy as measured by control sample recovery unless otherwise noted.
- (4) Representativeness as measured by field duplicates (see precision goals) and method blank analysis.
- (5) Completeness assessed on an analyte specific basis.
- (6) General sensitivity expectation. Analyte specific PQLs are presented in the method SOP or QA Manual for the laboratory (Attachment B).
- (7) General sensitivity expectation. Only units of measure are given.
- (8) Used in this context, DL = PQL.
- (9) Not used in this document
- (10) parts per million.
- (11) An exception is made in the case of USEPA defined "common laboratory contaminants" for which the control limit is 5X the DL.
- (12) parts per billion.
- (14) The USEPA validation "5X rule" will be applied.
- (15) The USEPA validation "4X rule" will be applied.

TABLE 3

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

NYSEG - AUBURN
FORMER MGP SITE

Test Type	Container	Preservation	Holding time
Field Measurements			
Field pH	4 oz. wide-mouth glass	N/A	Immediate
Field temperature	4 oz. wide-mouth glass	N/A	Immediate
Field conductance	4 oz. wide-mouth glass	N/A	Immediate
Lab Measurements			
NON-AQUEOUS SAMPLES			
VOCs (EPA Method 8260B)	4 oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 14 days.
BTEX (EPA Method 8260B)	4 oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 14 days.
SVOCs (EPA Method 8270C)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Extract within 14 days; analyze within 40 days.
Fingerprint/PAHs (Modified EPA Methods 8100/8270C)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Extract within 14 days; analyze within 40 days.
PCBs (EPA Method 8082)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Extract within 14 days; analyze within 40 days
Metals (EPA Method 6010B/7470A)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 6 months/28 days for mercury.
Cyanide, Total/Free (EPA 9012A/335.3)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 14 days.
Ferric/Ferrous Cyanide (Ion Chromatography)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze immediately.
Total Phenols (EPA Method 9065)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 28 days.
TOC (Lloyd Kahn)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 14 days.
Total Sulfur (ASTM D129-64)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 28 days.
NOD	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze immediately.
Reactivity (SW-846, Ch. 7, Sec. 3)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze immediately.
AQUEOUS SAMPLES			
VOCs (EPA Method 8260B)	Two (2) 40 ml septa vials, Glass	HCl to pH < 2	Analyze within 14 days.
BTEX (EPA Method 8260B)	Two (2) 40 ml septa vials, Glass	HCl to pH < 2	Analyze within 14 days.
SVOCs (EPA Method 8270)	1 Liter Glass	Cool 4 ° C	Extract within seven days; analyze within 40 days
Fingerprint/PAHs (Modified EPA Methods 8100/8270C)	1 Liter Glass	Cool 4 ° C	Extract within seven days; analyze within 40 days
PCBs (EPA Method 8082)	1 Liter Glass	Cool 4 ° C	Extract within 14 days; analyze within 40 days

TABLE 3**SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES****NYSEG - AUBURN
FORMER MGP SITE**

Test Type	Container	Preservation	Holding time
Metals (EPA Method 6010B/7470A)	32 oz., Plastic	HNO ₃ to pH < 2	Analyze within 6 months/28 days for mercury.
Total Phenols (EPA Method 9065/420.1)	500 ml, Glass	H ₂ SO ₄ to pH < 2	Analyze within 28 days.
Cyanide, Total/Free (EPA 9012A/335.3)	8 oz., Plastic	NaOH to pH > 12 0.6g ascorbic acid	Analyze within 28 days.
Ferric/Ferrous Cyanide (Ion Chromatography)	8 oz., Plastic	Cool 4 °C	Analyze immediately.
Alkalinity (EPA 310.1)	4 oz., Glass	Cool 4 °C	Analyze within 14 days.
Chloride (EPA 9252/325.3)	32 oz., Plastic	Cool 4 °C	Analyze within 28 days.
TOC, Dissolved (EPA 415.2)	8 oz., Plastic	Cool 4 °C	Analyze within 28 days.
Nitrate (EPA 9200/353.1)	8 oz., Plastic	H ₂ SO ₄ to pH < 2	Analyze within 48 hours.
Nitrite (EPA 1983/354.1)	32 oz., Plastic	Cool 4 °C	Analyze within 48 hours.
Sulfate (EPA 9038/375.4)	32 oz., Plastic	Cool 4 °C	Analyze within 28 days.
Sulfide (EPA 9030/376.2)	8 oz., Plastic	NaOH to pH > 12 / Zinc Acetate	Analyze within 7 days.
Dissolved Iron (EPA 200.7)	8 oz., Plastic	Cool 4 °C	Field filter immediately, analyze within 6 months.

Notes:

VOCs indicates Volatile Organic Compounds

SVOCs indicates Semivolatile organic compounds

PCBs indicates polychlorinated biphenyls

Metals include Al, Sb, As, Ba, Cd, Cr, Cu, Fe, Pb, Ni, Mn, Hg, Se, Ag, V, Zn

Selected samples may be initially processed using the Toxicity Characteristic Leachate Procedure (TCLP) (Method 1311).

TABLE 4
QUALITY CONTROL SPECIFICATION FOR ANALYSIS
NYSEG - AUBURN
FORMER MGP SITE

Test Type	Frequency	Criteria	Corrective Action
Metals			
Initial Calibration	according to manufacturer's specs. ¹	Repeat high standard within 5% of true	maintenance, repeat
Continuing Calibration	every 10 samples and end of run	$\pm 10\%$ D from initial ²	new initial calibration, repeat tests
Calibration Blank ³	every 10 samples and end of run	< RL ⁶	maintenance, repeat tests
Interference Check Sample	Beginning and end of run	%R within 20% of true	maintenance, repeat tests
Calibration Verification	after initial calibration	$\pm 10\%$ of True Value	repeat, new initial calibration
Lab Control Sample (LCS)	5%	80% < %R < 120%; in lab limits (soils)	maintenance, repeat tests
Duplicate Analysis	5%	RPD < 20%; 35% for soils ⁴	flag & note in narrative
Matrix Spike	5%	75% < %R < 125% ⁵	flag & note in narrative
Method Blank	5%	< RL ⁶	maintenance, repeat tests
Serial Dilution	5%	%D < 10% when sample > 100X IDL	perform PDS, flag & note in narrative
Post Digestion Spike	as required	85% < %R < 115%	flag & note in narrative
GC/MS (VOCs/SVOCs)			
Instrument Tune	Every 12 hours	As specified in reference method	maintenance, repeat
Initial Calibration	Initially and as required by con cals	%RSD < 15%; r > 0.990	maintenance, repeat
Calibration Verification	Following ical	%R $\pm$ 20% of true	repeat once, new ical
Continuing Calibration	Every 12 hours	%D < 20%	new ical
LCS	5% or per shift	Within lab limits	maintenance, repeat tests
Duplicate Analysis	5%	Within lab limits ⁴	note in narrative
Surrogates	every sample (3 per fraction)	Within lab limits ⁵	repeat, note in narrative
Matrix Spike	5%	Within lab limits	note in narrative
Internal Standards	every sample	+100%--50% of concal; within .5 min RT	repeat, note in narrative
Method Blank	5% or per shift	< RL ⁶	maintenance, repeat tests

TABLE 4
QUALITY CONTROL SPECIFICATION FOR ANALYSIS
NYSEG - AUBURN
FORMER MGP SITE

Test Type	Frequency	Criteria	Corrective Action
GC (PCBs)			
Initial Calibration	Initially and as required by con cals	%RSD < 20%; $r > 0.995$	maintenance, repeat
Calibration Verification	Following ical	%R $\pm$ 15% of true	repeat once, new ical
Continuing Calibration	Every 12 hours	%D < 15%	new ical
LCS	5% or per shift	Within lab limits	maintenance, repeat tests
Duplicate Analysis	5%	Within lab limits ⁴	note in narrative
Surrogates	every sample (2 per sample)	Within lab limits	repeat, note in narrative
Matrix Spike	5%	Within lab limits ⁵	note in narrative
Method Blank	5% or per shift	< RL ⁶	maintenance, repeat tests
Wet Chemistry			
Initial Calibration	according to manufacturer's specs. ¹	Repeat high standard within 5% of true	maintenance, repeat
Continuing Calibration	every 10 samples and end of run	$\pm 10\%$ D from initial ²	new initial calibration, repeat tests
Calibration Blank ³	every 10 samples and end of run	< RL ⁶	maintenance, repeat tests
Calibration Verification	after initial calibration	$\pm 10\%$ of True Value	repeat, new initial calibration
Lab Control Sample (LCS)	5%	80% < %R < 120%; in lab limits (soils)	maintenance, repeat tests
Duplicate Analysis	5%	RPD < 20%; 35% for soils ⁴	flag & note in narrative
Matrix Spike	5%	75% < %R < 125% ⁵	flag & note in narrative
Method Blank	5%	< RL ⁶	maintenance, repeat tests

(1) Manufacturer's specifications or instrument operations manual must be present in the field during use.

(2) Mercury $\pm 20\%$ of true.

(3) An initial calibration blank will immediately follow the Calibration verification and must meet this same specification.

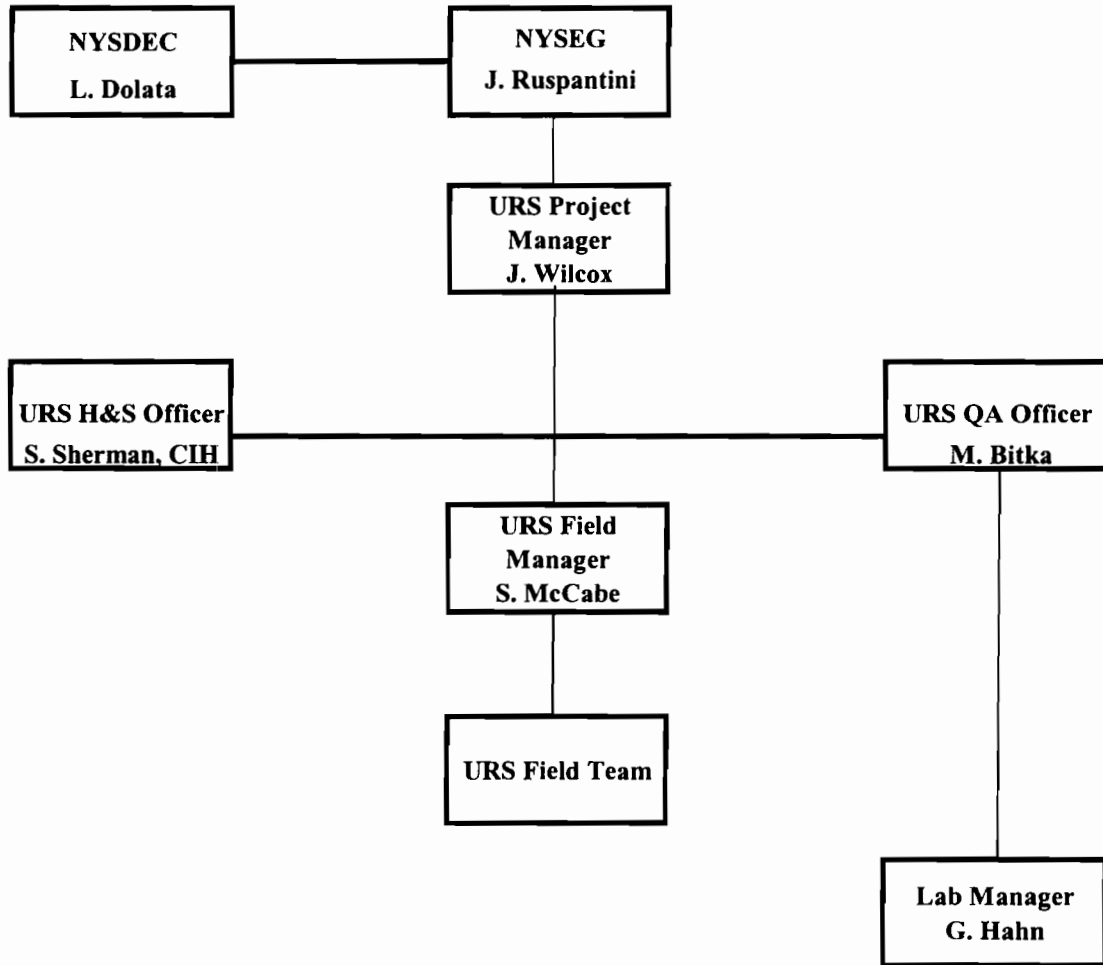
(4) USEPA National Functional Guidelines 5X rule applies.

(5) USEPA National Functional Guidelines 4X rule applies.

(6) RL = PQL.

FIGURE 1

**NYSEG Former Clark Street MGP Site
Organization Chart**



ATTACHMENT A
FORMS

CHAIN OF CUSTODY RECORD

PROJECT NO.

SITE NAME

SAMPLERS (PRINT/SIGNATURE)

DELIVERY SERVICE:

AIRBILL NO.:

LOCATION IDENTIFIER

DATE

TIME

COMP/GRAB

SAMPLE ID

MATRIX

TOTAL NO. # OF CONTAINERS

TESTS

BOTTLE TYPE AND PRESERVATIVE

REMARKS

SAMPLE TYPE

BEGINNING DEPTH (IN FEET)

ENDING DEPTH (IN FEET)

FIELD LOT NO. # (HAPMS)

HAZARDOUS WASTE

AA - AMBIENT AIR
SE - SEDIMENT
SH - HAZARDOUS SOLID WASTE

SL - SLUDGE
WP - DRINKING WATER
WW - WASTE WATER

WG - GROUND WATER
SO - SOIL
DC - DRILL CUTTINGS

WL - LEACHATE
GS - SOIL GAS
WC - DRILLING WATER

WO - OCEAN WATER
WS - SURFACE WATER
WQ - WATER FIELD OC

LH - HAZARDOUS LIQUID WASTE
LF - FLOATING/FREE PRODUCT ON GW TABLE

SAMPLE TYPE CODES

TB# - TRIP BLANK
SD# - MATRIX SPIKE DUPLICATE

RB# - RINSE BLANK
FR# - FIELD REPLICATE

N# - NORMAL ENVIRONMENTAL SAMPLE
MS# - MATRIX SPIKE

(# - SEQUENTIAL NUMBER (FROM 1 TO #) TO ACCOMMODATE MULTIPLE SAMPLES IN A SINGLE DAY)

RELINQUISHED BY (SIGNATURE)

DATE

TIME

RECEIVED BY (SIGNATURE)

DATE

TIME

RELINQUISHED BY (SIGNATURE)

DATE

TIME

RECEIVED FOR LAB BY (SIGNATURE)

DATE

TIME

SPECIAL INSTRUCTIONS

Distribution: Original accompanies shipment, copy to coordinator field files

URS

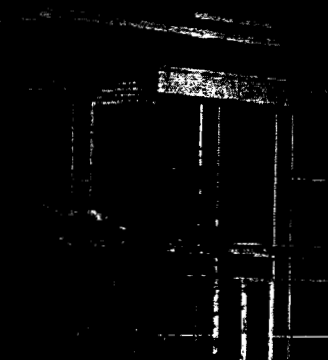
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ATTACHMENT B
LABORATORY QA MANUAL

Quality Assurance Manual



ASC analytical
services
center

Prepared for:
Ecology and Environment, Inc.
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Quality Assurance Manual

Revision No. 5
March 2004

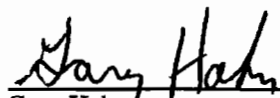
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The quality assurance system described in this Quality Assurance Manual has the support of the management at ASC (Analytical Services Center). Every member of the ASC staff is tasked to provide quality data to our clients. It is the responsibility of all personnel to use and follow this manual as a guide for quality improvement.

Signature:

Date:



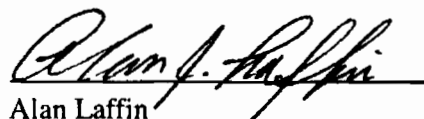
Gary Hahn
Technical Director

3-15-04



Raymond Piccione, Ph.D.
Laboratory Quality Assurance Coordinator

08 March 2004



Alan Laffin
General Manager

12 March 2004

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List of Acronyms

% D	percent difference
% R	percent recovery
AA	atomic absorption spectrophotometers
APHA	American Public Health Association
ASC	Analytical Services Center, a division of Ecology and Environment, Inc.
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BFB	bromofluorobenzene
BOD	biochemical oxygen demand
BOD ₅	5-day biochemical oxygen demand
CAD	computer-aided design
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	chain-of-custody
COD	chemical oxygen demand
DFTPP	decafluorotriphenylphosphine
DOC	Document Control Officer (ASC)
DOT	United States Department of Transportation
DQOs	data quality objectives
E & E	Ecology and Environment, Inc.
EDD	electronic data deliverables
EPA	United States Environmental Protection Agency
GAC	general analytical chemistry
GB	gigabyte

List of Acronyms (Cont.)

GC/MS	gas chromatography/mass spectrometry
HMTA	Hazardous Materials Transportation Act
HP	Hewlett Packard
HPLC	high performance liquid chromatography
IC	ion chromatography
ICP-AES	inductively coupled plasma – atomic emission spectrometry (-ter)
ICP-MS	inductively coupled plasma – mass spectrometry (-ter)
ICS	interference check samples
ICV	initial calibration verification
IPR	initial precision and recovery
KCl	potassium chloride
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LIMS	laboratory information management system
LRS	Laboratory Report System
MB	megabyte
MDL	method detection limit
mg/L	milligrams per liter
MS	matrix spike; mass spectrometry
MSD	matrix spike duplicate
MSDS	material safety data sheets
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NYCRR	New York Code of Rules and Regulations
OSH	Occupational Safety and Health Act
OSHA	Occupational Safety and Health Administration
PARCC	precision, accuracy, representativeness, completeness, comparability
PCR	polymerase chain reaction
PE	performance evaluation; same as PT

List of Acronyms (Cont.)

PT	performance test sample
ppm	parts per million
PQL	practical quantitation limit
QA	quality assurance
QAM	Quality Assurance Manual
QAPP	quality assurance project plan
QC	quality control
RAM	random access memory
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SOP	Standard Operating Procedure
SOW	statement or scope of work
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TOX	total organic halogen
TRPH	total recoverable petroleum hydrocarbons
UPS	uninterruptible power source
VIM	International Vocabulary of Basic and General Terms in Metrology

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Distribution Policy

The Quality Assurance Manual (QAM) distribution is maintained by the Document Control Officer (DOC). The document is not released without approval by the Corporate Quality Assurance (QA) Director or Laboratory QA Coordinator. Uncontrolled copies are generally released to outside clients or agencies.

When this QAM is revised and approved, it is distributed to each laboratory section.

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1

QA
quality assurance

ASC
Analytical Services
Center

QAM
Quality Assurance
Manual

QC
quality control

SOPs
standard operating
procedures

Introduction

This manual describes the quality assurance (QA) program employed at the ASC. It is intended to provide employees, accrediting agencies, and clients with an understanding of how the ASC maintains an effective QA system. The QAM is divided into 16 sections. The sections provide general descriptions of ASC objectives, policies, facilities, organization, personnel, services, and specific QA and quality control (QC) procedures as practiced within each area of operation. Referenced figures, tables, and standard operating procedures (SOPs) support the descriptions in the QAM sections and related documentation. The content of the QAM sections is not modified for specific clients or agencies unless the requirements of these clients become standard policy. Client-specific requirements are included in project-specific documents or in the client-specific sections of the operational SOPs, as appropriate.

The SOPs are maintained written procedures for implementing the activities described in this manual. The SOPs are made available to the staff as electronic documents as defined in the Document Control Procedure (see Section 11). All laboratory personnel assigned responsibilities outlined in this QAM are to adhere to the procedures and policies described here and in the laboratory SOPs.

The elements in this QAM describe a laboratory quality system that is designed primarily on the latest revision of Chapter 5 of the National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Manual. The NELAP Quality Systems Manual is a more descriptive development of the manual ISO 17025, an international standard that states minimal requirements for testing laboratories. Enhancements to the laboratory quality system were derived further from other program-specific QA manuals and external and internal audits and are described in various laboratory standard operating procedures (SOPs).

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2

Definitions

Definitions for this QAM are taken from the National Environmental Laboratory Accreditation Conference (NELAC) *Quality Systems Manual*; "Test Methods for the Evaluating of Solid Waste, Physical/Chemical Methods," United States Environmental Protection Agency (EPA) SW-846, Update III, June 1997; and other relevant state and federal guidance. The NELAC manual quotes relevant definitions from ISO/IEC Guide 2; ISO 8402; ANSI/ASQC E-4, 1994; the EPA "Glossary of Quality Assurance Terms and Acronyms"; and the *International Vocabulary of Basic and General Terms in Metrology* (VIM), 1994 and others. These definitions are provided in Appendix A. The list of standard definitions is referenced in internal SOPs. The SOPs include any definitions related specifically to that procedure.

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3

Organization and Management

3.1 Company

The location, mailing address, and phone numbers for ASC are:

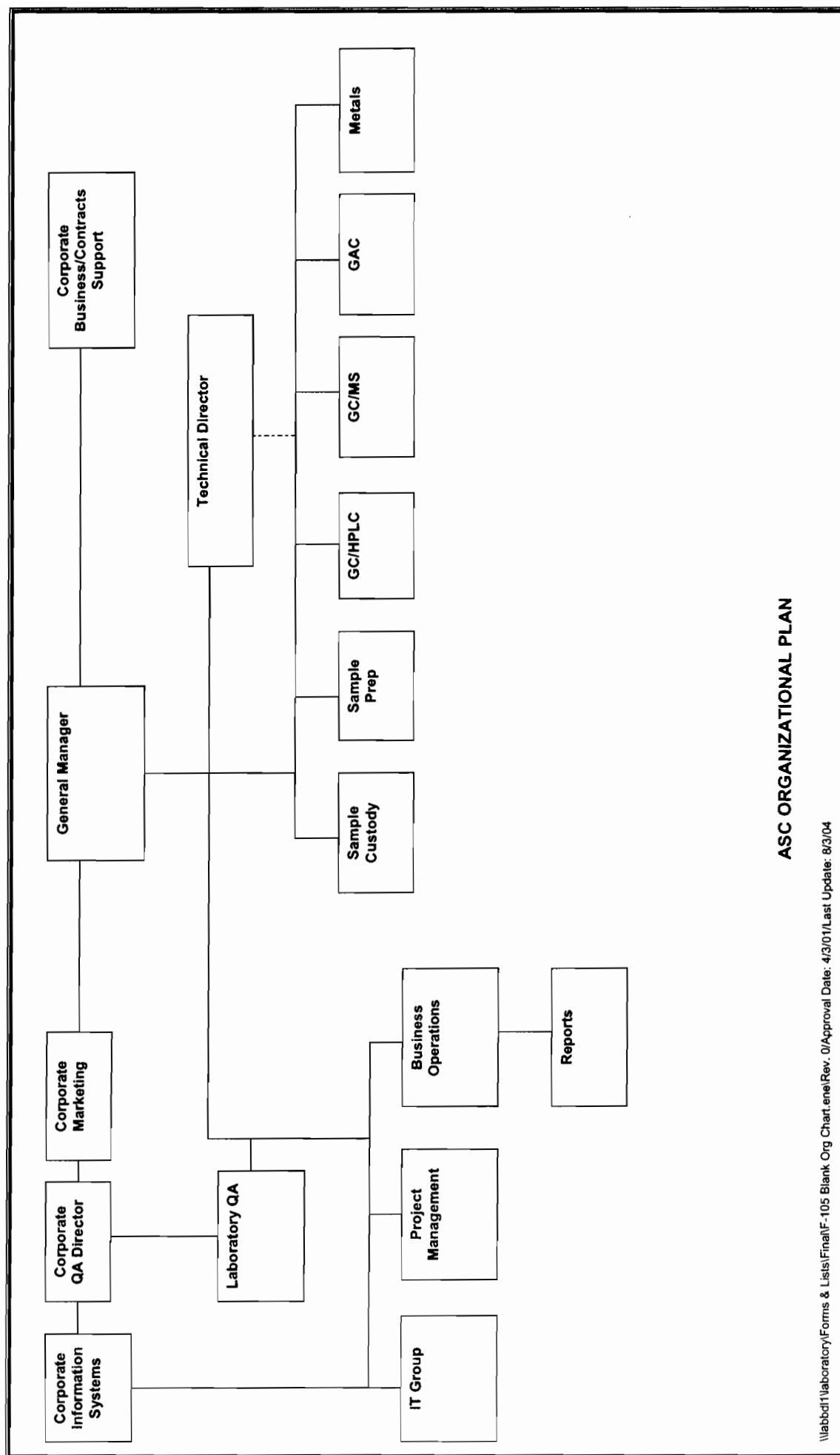
Analytical Services Center
a division of ecology and environment, inc.
4493 Walden Avenue
Lancaster, New York 14086
Telephone: (716) 685-8080
Facsimile: (716) 685-0852
Electronic mail: alaffin@ene.com
Website: www.ene.com

The ASC is a publicly held corporation registered and incorporated in the State of New York. E & E has been in business since 1970; ASC is a division of E & E. ASC serves environmental businesses; local, state, and federal agencies; industry; and various international projects.

3.2 Organization

The ASC's services include analysis of samples. The primary contact at ASC for analytical testing is the General Manager. In addition to standard laboratory analyses, ASC provides other services in conjunction with E & E's corporate staff.

The QA and management structure at ASC is presented on Figure 3-1. Appendix G shows the organizational chart with current staffing. The ASC is divided into the following production sections: organic sample preparation, gas chromatography/mass spectrometry (GC/MS) semivolatiles, GC/MS volatiles, GC volatiles, GC semivolatiles, high performance liquid chromatography (HPLC), metals sample preparation, metals analysis, general chemistry, and sample custody. Project management, information technology, QA, and administrative units operate in conjunction with production work groups but report independently to the General Manager.



ASC ORGANIZATIONAL PLAN

Responsibilities and authority of key personnel are summarized in this section. Resumes of key ASC personnel are found in the company's training record files.

3.2.1 Responsibility and Authority

All personnel are responsible for establishing, implementing, maintaining, and enforcing procedures for data quality management and control as defined in the QA Manual (QAM) and related documentation. Each person is responsible for the day-to-day quality of data and the services performed. The overall responsibilities of the ASC staff are defined below. Additional specific job functions and duties are listed in the job descriptions for the following positions. Job descriptions are maintained in the QA files.

General Manager

- Ethics training.
- Reports to E & E ASC Executive Committee.
- Directs Marketing.
- Designates the Laboratory Quality Assurance Coordinator.
- Designates Section Supervisors.
- Oversees Support staff.
- Ensures adequate resources are available to all staff to meet the objectives of the QA program.
- Directs business operations.
- Information Technology coordination.
- Conducts an annual management review of all quality systems in conjunction with the Technical Director and Corporate QA Director.
- Names, in the event of a temporary absence (15 consecutive calendar days) of Technical Director, a chief-level project manager to fulfill the director's duties.

Technical Director

- Reports to the General Manager and is responsible for all technical operations.
- Duties include monitoring standards of performance in quality control and quality assurance; monitoring the validity of the analyses performed and data generated to assure reliable data.
- Understanding client and market needs, requirements, or standards.
- Ensuring that data reported meet the method or client-specific requirements.
- Overseeing data quality issues that affect the client.
- Participating in quality decisions affecting any client.

Laboratory QA Coordinator

- Reports to the General Manager. May report directly to the Corporate QA Director any QA concerns.
- Implements and reviews all QA practices, including corrective actions, internal audits, training, and other activities as defined in Section 4.3.
- Monitors and reports to the Technical Director and General Manager on the status of all QA-related matters.
- Oversees maintenance of the QAM, the QA files, and other version-controlled documents as current documents.
- Oversees retrieval of all laboratory records as defined for archiving in the document control procedure.
- Is independent of all production responsibilities.

- Has authority to halt production for continuing QC or QA problems.

Section Supervisors

- Report to the Technical Director for all technical and production matters.
- Coordinate with the Technical Director to evaluate the resources available for daily work production.
- Responsible for weekly production.
- Review data and evaluate the QC elements for recurring or continuing nonconformances.
- Work with the Technical Director and General Manager to resolve process and system nonconformances.
- Responsible for overseeing and maintaining staff training.

Project Managers

- Report to the General Manager for all matters related to client services.
- Implement and reviews all QA and QC practices as defined in the project- or client-specific requirements.
- Maintain all project files and client QA/QC documentation.
- Communicate relevant information to the appropriate staff.
- Report all client complaints via the corrective action process.

Technical Staff

- Report to the Section Supervisor for work assignments and scheduling of samples to be analyzed.

- Responsible for performing work according to the SOP, meeting agreed-upon time scale, and achieving the QC criteria defined in the SOP (or advising supervisor of failure).
- Records information on a corrective action form when QC criteria are not within defined limits, or when procedures deviate from the SOP or client requirements.
- Performs all necessary administrative operations according to the documented SOP, including corrective action, document control, data review, traceability, and sample management.
- Performs all necessary ancillary technical operations according to the documented SOP or good laboratory practice, including routine preventative maintenance, standard preparation and inventory, and calibration of instruments and equipment.

Sample Custody Staff

- Report to the General Manager or designee for all matters related to sample receipt, handling, and disposal.
- Responsible for performing work according to the sample management SOPs and performing all operations within agreed-upon time scale.
- Record information on a Project Manager notification form when samples or materials are received that do not conform with client or method requirements.
- Perform all necessary administrative operations according to the documented SOP, including corrective action, document control, data review, and traceability.

Quality Assurance Staff

- Report to the Laboratory QA Coordinator for the job duties assigned.

- Record information on a corrective action form when data or other information is received that does not conform with the SOP or client requirements.
- Perform all necessary administrative operations and record keeping according to the documented SOP, including corrective action, document control, and data review.

Administrative Staff

- Report to the Business Manager or designee for the work area assigned.
- Responsible for performing work according to the assigned SOP and performing all operations within agreed-upon time scale.
- Record information on a corrective action form when data or other information is received that does not conform with the SOP or client requirements.
- Perform all necessary administrative operations and record keeping according to the documented SOP, including corrective action, document control, and reporting.

Corporate Quality Assurance Director

The corporate QA Director ensures compliance with the Corporate QA Program. The corporate QA Director remains independent of day-to-day, direct project activities, but is responsible for ensuring that all QA/QC requirements are met. The parent company assists with QA oversight at the laboratory and utilizes staff with appropriate training and expertise to evaluate those operations.

3.2.2 General Verification Responsibilities for All Personnel

Verification activities include inspection and monitoring of process and data quality, and auditing the quality system, processes, and data. Effective verification is achieved by providing personnel with adequate resources, including adequate training, supplies, and

equipment; time for verification activities; knowledge of requirements and documented procedures; and access to quality records.

Technical personnel, under the direct supervision of the Section Supervisors, are responsible for the inspection and monitoring of in-process and final data. Audits of the quality system and process are performed by personnel who do not have direct responsibility for the work being performed. Quality system audits are carried out by the Laboratory QA Coordinator. Process audits are scheduled by the Laboratory QA Coordinator and carried out by designated personnel and trained internal auditors (see Section 4.4).

3.2.3 Management Review

The Laboratory QA Coordinator reports directly to the General Manager, functions independently of production, and has the authority to implement and maintain the quality system. The Laboratory QA Coordinator is a participant in weekly meetings with supervisors and management representatives to discuss the status of quality issues and expectations in the laboratory sections. The Laboratory QA Coordinator reports to management on the status of all QA activities, including open and closed corrective actions, internal audit results, external audit results, status of certifications and approvals, client complaints, and major quality issues. Updates are provided to the General Manager in a monthly report. The Laboratory QA Coordinator interacts with personnel at all levels throughout the organization.

A management review of the quality system is conducted annually by the Technical Director, General Manager, and Corporate QA Director. The management review must ensure that the quality system remains effective, meets quality objectives and policies, and satisfies the requirements of state and federal certifications or approvals held by the ASC. Management review includes review of the annual QA systems audit and changes in laboratory operations, staff activities, and client concerns. The management review includes areas for improvement in relation to quality systems.

4

Quality System

4.1 Objective

The objective of the staff at ASC is to provide data and services that are legally defensible, scientifically valid, timely, and to the satisfaction of clients' expectations.

4.2 Policies

The management of ASC supports the following policies in order to achieve the objective and promote the overall QA program:

- Laboratory procedures, including client requirements, are documented in SOPs that clearly communicate these procedures to laboratory personnel.
- Management emphasizes quality improvement through commitment and leadership.
- A comprehensive QC system has been established and is maintained to verify and assure continued precision and accuracy of analytical results.
- Adequate training on laboratory operations is provided for all employees whose decisions affect the quality of laboratory data and services.
- A comprehensive program of documentation has been implemented and is maintained to ensure accountability and traceability throughout the analytical process.
- Measures are taken to ensure that sample integrity is protected.
- Studies are performed to demonstrate the capabilities for each analytical method.

Quality control: A system of activities applied at each stage of the data production process designed to ensure that data meet defined quality standards. This system includes the following: system, operational, and performance audits; reference materials; statistical evaluations; re-analysis; and measurement bias investigation (when measurements may be operator-, instrument-, or methodology-dependent).

Quality assessment: A system of activities designed to ensure that quality control takes place at each stage of the production process. This system includes the following: employee education, training, and experience; documentation (e.g., instructions, document control, records); instrument calibration and maintenance; traceability of samples, data, and methods; laboratory facilities; and inspection.

PT

Performance test sample. Also known as performance evaluation sample (PE).

- The instrumentation, equipment, and materials used in the production process are controlled to ensure that required quality standards are within specifications.
- A comprehensive program for data reduction, review, reporting, and archiving is maintained.
- Preventive and corrective actions are taken, as necessary, to eliminate the causes of potential or actual nonconformance.
- Measures are taken to fulfill the requirements of agencies from whom certifications and accreditations have been granted.
- Client-specific requirements are incorporated in the overall QA program by addendum to appropriate SOPs.

4.3 Quality Assurance

Through a formal QA system, ASC provides testing services that meet specific quality standards. These quality standards are defined to meet the needs and requirements of clients, the analytical methods used, government agencies, and E & E's senior management. Quality Assurance is composed of **quality control** and **quality assessment**.

The ASC management is accountable for the quality of the services provided, and each employee is an integral part of achieving the system objectives. This section is limited to a discussion of the major activities performed and administered by the QA unit; policy details are discussed throughout this manual.

The QA program at ASC is affected by the requirements of certification agencies. The Laboratory QA Coordinator is directly responsible for coordination of the following external quality assessment activities:

- On-site audits by outside agencies;
- Analysis of performance test (PT) samples;
- Corrective action responses to deficiencies cited in external audit reports and external PT results; and

- Dissemination of requirements and status of certifications to relevant laboratory personnel and project managers.

4.3.1 Quality Assurance Unit

At ASC, the QA unit monitors the QA system and reports the results of its observations to the Technical Director and the General Manager. The Laboratory QA Coordinator has no direct responsibility for production, scheduling, or workflow in the laboratory. The objective of this independence is to eliminate all conflicts of interest in the performance of QA duties. Major activities performed and administered by the QA unit are summarized below. Each activity is discussed in greater detail elsewhere in the QAM.

- Performance of internal audits and coordination of external audits (Section 4.4);
- Administration of laboratory certification/accreditation programs (Section 4.7);
- Administration of External Proficiency Testing (PT) programs required for certification and internal PT programs to check the quality system;
- Administration of a system for formal corrective action reports (Section 4.5);
- Administration of the document control system, including the publication of the QAM (Section 11) and other documents that describe ASC's QA system;
- Administration of SOPs and test codes;
- Administration of the in-house training program (Section 5.5);
- Administration of in-house analysis controls (control limits, method detection limits, demonstrations of capability; and
- Administration of Ethics Program with General Manager.

4.4 Audits

The ASC conducts internal audits in which the laboratory reviews and examines itself, and undergoes external audits in which the laboratory is audited by outside organizations. Internal system audits are defined in the internal audit SOP QA.19 as operational and system audits.

4.4.1 Internal Audits

The internal audit is a review of the quality system as it is employed in the laboratory. Auditors verify that adequate written instructions are available for use; that analytical practices performed in the laboratory are consistent with SOPs; that the QC practices are applied during production; that corrective actions are applied as necessary; that deviations from approved protocols occur only with proper authorization and documentation; and that SOPs, quality records, analytical records, and magnetic tape are properly maintained.

System Audit

An internal system audit is conducted by the Laboratory QA Coordinator yearly. The system audit is a review of the overall system of operations and is used to verify that corrective actions are being implemented effectively. The system audit is a sampling of all operations and include sample tracking from receipt to disposal, a data audit of a completed report, and audits of ancillary operations as necessary to support the data audit. Data audits ensure that data comply with method and SOP requirements, deliverable specifications and standard traceability. The internal system audit report is provided to laboratory management and forms the basis for management review of the quality systems described in Section 3.2.3.

Operational Audit

The Laboratory QA Coordinator schedules internal operational audits yearly. The operational audits are a more detailed review of laboratory (procedure) operations. They are performed by analysts, Management, or supervisors from sections other than those being audited or by the Laboratory QA Coordinator. This manner of conducting operational audits allows for the challenging of set practices and the exchange of ideas, improving production flow and operations.

Prior to a scheduled audit, checklists or the SOP specific to the area are reviewed by the assigned auditor. The checklist or notes

from the audit are returned to the Laboratory QA Coordinator as part of the audit report. The specific contents and process for conducting and reporting on the audit are detailed in the internal audit SOP QA.19. Any deficiencies or nonconformances found during the audit are recorded on a corrective action form. The corrective action procedure is followed to ensure the nonconformance is corrected.

4.4.2 External System Audits

Representatives sent by clients, government, or accrediting agencies often perform system audits at the ASC. These audits are announced inspections. The Laboratory QA Coordinator or Laboratory Management accompanies the external audit team through the laboratory. The auditors receive a brief overview of company objectives, activities, and facilities. Interviews with essential supervisory and technical staff are arranged and any documentation pertinent to the audit is retrieved. Auditors typically provide a report on their findings shortly after the audit. This account is evaluated by the Laboratory QA Coordinator and reported to management, along with corrective action forms responding to any cited deficiencies.

4.4.3 Performance Test Samples (or Proficiency Evaluation Samples)

A PT sample analysis is the analysis of a fortified blank sample or real world sample for the purpose of evaluating laboratory or analyst performance. The PT samples are submitted by or purchased from a NELAC-approved PT provider and have analyte concentrations unknown to the ASC. The PT sample may be analyzed in conjunction with accreditation programs, or as blind and double blind check samples submitted by clients.

Generally, the PT samples are used to maintain the laboratory's NELAP accreditation, but are also used for other (non-NELAP) state certifications. Performance test samples may be used to provide information to an accrediting agency on correction of past performance on a performance test sample.

ASC also invests in an internal proficiency testing program designed to check analytical systems. The internal PT samples are purchased from a NELAC-approved PT provider for random methods throughout the year.

4.5 Corrective Action

The ASC takes the necessary actions to prevent or correct nonconformances in data and services. When corrective actions result in permanent procedural changes, pertinent documentation (e.g., SOPs) is modified to reflect these changes. A formal corrective action reporting system, administered by the QA unit, is in place at ASC. The process is described in the corrective action SOP QA.1 and is applicable to all nonconformances or client concerns.

Routine corrective actions are made by the analysts, technicians, or other personnel who detect problems or nonconformances during analysis of samples. The SOPs for testing procedures contain instructions for implementing and documenting corrective actions for typical problems. These actions are typically noted in the laboratory section documentation. Any data reported outside SOPs or project requirements must be described on a corrective action form submitted with the results for project manager approval.

Sample custody concerns, such as problems during cooler receipt or holding time violations, are reported immediately on a Project Manager Notification form to the project manager for resolution. Deviations from the SOP and other activities that require approval or actions by others also may be recorded on the corrective action form (see Appendix B).

All non-routine problems, deficiencies, or irregularities are reported to management as part of the corrective action process. The corrective action process is used to report all audit findings from both external and internal audits as well as client issues or complaints from the review of analytical data.

The QA unit monitors the progress of corrective actions, maintains completed documentation, and provides reports to the General Manager on the status of the corrective action activities. Corrective actions may be originated by any ASC personnel. The corrective action request is sent to a person designated as responsible for completing or overseeing the corrective action. This person is responsible for recording the corrective action plans, implementations, and follow-up actions to be completed. During the corrective action process, several measures may be taken, including: determination of the root cause through careful analysis of processes, specifications, quality records, customer complaints, and use of statistical process control; implementation of process controls to

ensure that effective corrective action is taken; application of remedial actions to reports or data affected by the identified problem; and revision of documentation for procedures that changed as a result of the corrective action. The goal of the corrective action process is to identify the root cause of the system failure and to put into practice a modification or new procedure that will keep that system in compliance.

4.6 Quality Control

QC is applied at every stage of the testing process at ASC. Its purpose is to assure that the data reported to clients are within defined acceptance and performance criteria. QC activities are described in many sections of this manual; this section presents those QC activities that are quantified with defined acceptance and performance criteria.

The criteria are derived from several sources, including requirements of the analytical methods, needs stated by clients, and standards established within the ASC. During the generation of data, verification activities evaluate the performance of the measurement to the specified criteria. These verification activities include data review by a peer reviewer, proofreading of all data entry, project-specific review, and a data review by the Laboratory QA Coordinator on a random selection of the final reports (see Section 12.2).

When defined quality standards have not been met (a nonconformance), the corrective action process is initiated to document and track the nonconformance and the corrective actions taken. The Laboratory QA Coordinator and Technical Director or their designees review the information to determine the effectiveness of the QC system.

4.6.1 Data Quality Objectives

The data quality objectives (DQOs) are developed by the client during the design of a given study and typically presented to the laboratory as a Quality Assurance Project Plan (QAPjP) or contract scope or statement of work (SOW). The DQOs are qualitative and quantitative indicators used to define the quality of the data needed to support specific project decisions. DQOs specify critical data points or acceptance criteria to be achieved to make the proper decision. The qualitative and quantitative indicators are often expressed as precision, accuracy, representativeness, completeness,

and comparability (PARCC). Achievement of these quality indicators helps to demonstrate that the data are scientifically valid, legally defensible, and adequately meet client requirements as stated by the DQOs. The laboratory reviews all project-specific DQOs made available to it and identifies any areas in which internal QC criteria indicate project DQOs may not be achievable (see Section 13).

Precision

Precision measures the reproducibility of measurements under a defined set of conditions. It is a quantitative measure of the variability of a group of measurements compared to their average value. Precision is usually stated in terms of standard deviation, coefficient of variation, or relative percent difference (RPD) between two values. Precision is determined in the laboratory by evaluating laboratory duplicates, matrix spike duplicates, or replicate measurements of the sample or standard. Precision measurements for overall sampling and analytical testing are evaluated through field duplicates or split samples.

Accuracy

Accuracy is a quantitative measure of the relationship of reported data compared to the true or expected values and includes a combination of random and systematic error. Accuracy is determined in the laboratory by evaluating the recoveries of laboratory control samples (LCS), through the use of surrogate spikes, and stated in terms of percent recovery or the average (arithmetic mean) of the percent recovery. Accuracy measures for overall sampling and analytical testing are evaluated through blank samples, background samples, or external PT samples.

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 that 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, the sampling must be designed not only to collect samples that represent conditions at a sample location, but also to select sample locations that represent the total area to be sampled.

Representativeness is usually dependent upon sampling techniques not controlled by the laboratory; however, there is representative-

ness of sub-samples prepared within the laboratory from collected samples. Parent samples must be subjected to thorough homogenization prior to sub-sampling to ensure unbiased measurements within the laboratory. Sample duplicates prepared in the laboratory are a measure of the representativeness.

Completeness

Completeness is defined as the percentage of measurements performed that are judged to be valid. A quantitative goal defines how much valid data must be generated to make a decision regarding completeness. Critical samples typically have higher completeness goals than noncritical samples and require additional measures of QC. In the laboratory, the quantitative measure of the amount of valid data is obtained from the analytical process and compared to the amount that was expected to be obtained. Valid data are data that are not rejected for failure to meet project DQOs.

Comparability

Comparability is a qualitative measure of the confidence with which one set of data can be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. Characteristics that make comparison possible include method performance samples as defined in Section 4.6.2; QC samples as defined Section 4.6.3; standardized report format; consistency of units (e.g., milligrams per liter [mg/L], parts per million [ppm]); and standardized sample collection, preparation, and analysis procedures. PT samples also help establish comparability of results between laboratories.

4.6.2 Method Performance

For a given analytical method, the ASC demonstrates laboratory capability in performing the method by extension of an analyst's demonstration of capability to perform the method. Analysts continue to demonstrate this ability as long as the method is used. The laboratory analysts demonstrate the ability to meet the precision and accuracy criteria stated in the method (if available) and defined in the demonstration of capability SOP A.23. The demonstration normally requires analysis of four replicate samples. Each individual analyst also demonstrates the ability to perform the method in accordance with the training SOP QA.5 and method requirements. On an ongoing basis, the laboratory analyzes calibration standards as defined in Section 8, QC samples as defined in Section 4.6.3,

and PT samples as defined in Section 4.4.3 to demonstrate method capability.

Method Detection Limits

Method sensitivity is defined as the concentration of an analyte in a given matrix necessary to produce a detectable response. The sensitivity is measured for each analytical method as defined below. The method detection limit (MDL) for all quantitative analyses is determined based on the reference procedure found in 40 CFR Part 136, Appendix B per the MDL SOP A.18. The MDL SOP details the calculations and iterative process for determining the MDL. An MDL is determined for each method and matrix during method start-up and whenever the basic chemistry of the procedures is changed.

For some clients or programs, the MDL determination is an annual requirement for each instrument of use. These special considerations are also detailed in the SOP A.18.

Practical Quantitation Limits

The practical quantitation limit (PQL) is the reporting limit used by the laboratory. The PQL must be greater than the MDL and is approximately three times the MDL or greater but is also dependent on client requirements (SOP A.18). The lowest standard used for calibration is at or below the PQL.

4.6.3 Quality Control Samples and Splits

Analytical performance is monitored through QC samples and spikes, such as laboratory method blanks, surrogate spikes, laboratory control samples, matrix spikes, matrix spike duplicates, duplicate samples, and duplicate injections. Many of the QC measures applied at ASC are summarized below. Laboratory QC criteria are defined in the appropriate method SOP. A hierarchy is established in the application of QC criteria: project-specific, method then laboratory-derived requirements.

All QC samples are applied on the basis of a laboratory batch. The laboratory batch associates samples that are prepared or analyzed together as described in the batching SOP A.22. The laboratory defines two basic types of batches: the preparation batch and the run (i.e., analytical) batch. The preparation batch includes all samples processed as a unit during organic sample preparation,

metals digestion, or general chemistry preparation. Preparation batches do not exceed 20 samples excluding associated QC samples except as noted in certain projects in the method SOP. The QC samples associated with sample preparation include method blanks, LCS, matrix spikes, and duplicates. The run batch is 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 verification standards. The specific procedures for documenting the laboratory batch are defined in the batching SOP. Additional batches may be defined for unique steps of the analytical process, such as a clean-up batch or reporting batch, and these additional batches are defined in the laboratory case narrative.

Laboratory Method Blank

A laboratory method blank is an analyte-free material processed in the same manner and at the same time as a client sample. The blank is prepared using American Society for Testing and Materials (ASTM) Type II water when analyzing water samples, and where practical, pre-cleaned sand or other solid material, such as sodium sulfate, when analyzing solid samples. The laboratory method blank sample is prepared along with the client samples at a frequency of one laboratory method blank per batch of 20 (or fewer) of client samples for the given matrix type.

The 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 level in the samples as defined by the method SOP or the project. If contaminants are present in the method blank but not in client samples, no further action is generally required. If contamination is greater, the entire batch is reprepared and reanalyzed. All sources of contamination that are not common laboratory contaminants as defined in the method SOPs are investigated as part of the corrective action process. Sample results are not blank subtracted unless specifically required by the analytical method.

Surrogate Standards

For certain organic methods, all samples, including the laboratory method blank, QC samples (MS, MSD, LCS), and standards, are fortified (spiked) with a set of specific surrogate standards to monitor the accuracy of the analytical determination. Surrogate spikes are added at the start of the laboratory preparation process. Surrogate compounds are not typically found in environmental samples. QC criteria for surrogate recoveries are method-and matrix-specific. Laboratory QC criteria are established after a sufficient number of data points (40 or more) is performed and reviewed annually as defined in the Control Charting SOP QA.20.

Surrogate recoveries within QC criteria for method blanks and LCS samples demonstrate acceptable method performance. If surrogate recoveries are outside QC criteria for method blanks or LCS samples, corrective action is required as defined in the appropriate method SOP. 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 are verified based on review of recoveries in the method blank or LCS, sample reanalysis, or evaluation of interfering compounds. Sample clean-up procedures may be appropriate to alleviate potential matrix problems. Standard procedures for evaluating surrogate recoveries in samples are listed in the appropriate method SOPs. However, these procedures are often modified by project- or client-specific requirements.

Laboratory Control Sample

An LCS consists of ASTM Type II water, and where practical, pre-cleaned sand, glass beads, Teflon™ chips, or sodium sulfate for solid matrices, or a purchased quality control sample. The LCS is spiked with the analytes of interest (or a representative subset) usually near the mid-point of the calibration range. It then follows the same sample preparation, standard addition, and analysis as client samples. The LCS concentration may be specified in the reference method or project-specific requirements. Laboratory Control Samples are analyzed at the frequency of one per batch of every 20 samples or fewer. The recovery of target analytes in the LCS is a measure of method accuracy and laboratory performance.

LCS recoveries are monitored on control charts. Laboratory QC criteria are established for each method and matrix using a minimum of 40 points. When the LCS recovery is within the control limits, the method performance is considered acceptable.

If the number of LCS recoveries as specified in the SOP are outside QC criteria for the target analytes, corrective action is required. QC criteria and appropriate corrective actions are defined in the specific method SOPs. After corrective action is complete, sample reanalysis may be required for the failed parameters. If LCS recoveries are above the high limit, exceed the QC criteria, and that parameter is not found in any of the samples, reanalysis is not necessary unless specifically required for the project.

Matrix Spike Sample

An MS sample consists of a client sample (often specified by the client) split into two parts and processed as two separate samples in a manner identical to that of the rest of the samples in the batch. In addition to the regular addition of monitoring standards (internal standards, surrogate), spiking analytes are added to one aliquot of the chosen sample before preparation. Generally, all method target analytes, if compatible are added. A subset, as indicated in the method SOP, is reported unless specified otherwise by the client. The spike concentration levels for the target analytes are defined by the analytical method or by project-specific requirements or are specified by the laboratory in the analytical SOP. An MS is prepared for every extraction batch of 20 samples (or fewer) for a given matrix if sufficient sample allows. The sample chosen for matrix spike is random except that field and trip blanks are not chosen for spiking. Clients may specify the sample(s) to be spiked. The client must provide ASC with extra sample amounts for samples requiring matrix spikes.

The percent recovery (%R) is calculated as:

$$\%R = \frac{X_1 - X_2}{|A|} \cdot 100\%$$

where:

- % R = the percent recovery
- X_1 = the measured concentration of the sample with the spike addition
- X_2 = the measured concentration of the unspiked sample
- A = concentration of the spike added

Due to matrix effects, matrix spike recoveries are not a measure of the performance of the method on the sample being analyzed. In the absence of observable quantitative interferences, an MS sample recovery that exceeds QC limits indicates matrix effects. For these reasons, MS recoveries are not used to control the method, i.e., determine reanalyses. The results of the MS are evaluated, in conjunction with other QC information to determine the effect of the matrix on the bias of the analysis.

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 client sample and processed with the same additions as the MS. The sample chosen for matrix spike duplicate must be the same as that chosen for 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 measure the precision of the analytical method on the actual client samples. Laboratory QC criteria for RPD may be established as specified in the Control Chart SOP QA.20 or by method requirements. Control charts are available to investigate recoveries on client-specific samples or for troubleshooting. For the MSD sample, the client must provide ASC with extra sample amounts. If insufficient sample is available, the laboratory may run an LCS duplicate to measure precision, depending on the method.

The relative percent difference (RPD) is calculated as:

$$RPD = \frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2} \right)} \cdot 100\%$$

where:

- RPD = the relative percent difference
X₁ = the concentration or percent recovery of the sample
X₂ = the concentration or percent recovery of the duplicate sample

Duplicate Sample

A duplicate sample consists of a set of two samples obtained in an identical manner from the same client sample. The collection of duplicate samples from a heterogeneous matrix requires homogenization to ensure that representative portions are analyzed. One duplicate sample per batch of same matrix of 20 samples or fewer is analyzed. The sample chosen for duplicate analysis is random except that field and trip blanks are not used. Clients may designate the sample for duplicate analysis. The client must provide sufficient sample to allow for duplicate testing.

The duplicate is prepared for methods that typically show concentrations of target analytes above MDL, such as metals and general chemistry methods. The RPD between the recoveries in the original and duplicate measure the precision of the analytical method on the actual client samples. Laboratory QC criteria for RPDs are established for each method and matrix as defined in the Control Chart SOP QA.20. Control charts are available to investigate recoveries on client-specific samples or for troubleshooting.

If all other QC criteria are met, matrix effects may be established by observing the sample to determine any visual heterogeneity. If visual observation does not indicate a potential problem, the sample may be reanalyzed. Potential matrix effects are reported in the case narrative.

Splits

Clients may request that samples be split and sent to another laboratory, or they may split the samples and submit them to a minimum of two laboratories. Splits are often performed to evaluate the comparability and reproducibility of the data for critical decision making, or when sample re-collection is not practical. These

inter-laboratory studies are defined in the client documentation. Data resulting from splits are evaluated by the client. Sample splits must be representative of the sample submitted. Errors from sample splitting must be minimized by ensuring that the sample is adequately mixed prior to splitting.

Other Laboratory QC Samples

The laboratory performs analysis of other QC samples or standards, depending on the analytical method. Standard QC samples or standards are documented in the specific method SOP. Method-specific QC samples or standards include internal standard spikes for GC/MS methods; post-digestion spikes and serial dilutions for metals analysis; and interference check samples (ICS) for inductively coupled plasma (ICP-AES and ICP-MS) analysis.

Field QC Samples

To evaluate the overall sampling and analytical data quality indicators, the client submits QC samples from the field. The field QC samples include trip blanks, field blanks (such as ambient condition blanks or equipment blanks), and field duplicates. Trip blanks may be prepared in the laboratory as described in Section 10. The project managers will normally track the field QC samples to ensure that the frequency of sampling and analysis is consistent with project requirements. In most cases, the analytical staff are typically not aware of which samples are the field QC samples. In cases when MS/MSD samples are not client-specific for water sample analysis, the analyst should review the client samples to ensure that MS/MSD analysis is not performed on field blanks.

4.6.4 Statistical Evaluation

Statistical evaluations are performed for the quality indicators, MDL, surrogates, and laboratory control samples. Control charts offer the most graphic representation of a statistical evaluation. Control charts identify potential problems, and the causes of these problems are promptly investigated and eliminated. Internal QC criteria are determined through historical trend analysis of data collected on QC charts. The control chart process is defined in the control chart SOP QA.20. The control chart procedure allows for identification of points outside QC criteria or potential QC problems by evaluation of trends.

Control charts are plotted for the percent recovery of surrogates, and LCS compounds, as determined by the individual method SOP or certifying agency requirement.

4.7 Accreditations, Certifications, Licenses, and Registrations

The ASC has approval from various state, federal, and national agencies for performing analytical testing. The laboratory has been granted numerous certifications and accreditations, based upon compliance with standards set forth by the granting agencies. The certifications are summarized in Appendix C. The ASC is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory in a number of states, with primary accreditations from New York State and Florida. The scope of approval is based on each agency's requirements with regard to regulatory requirements, methodologies, or matrix. The process used by an agency for granting approval is presented in Table C-1 (Appendix C) in the column 'Scope of Evaluation'.

5

Personnel

5.1 Job Qualifications for Key Technical Personnel

The following are the minimum experience, education, and qualifications required for key personnel. Specific job descriptions for each laboratory function are maintained in the QA files.

Technical Director: Experience in environmental laboratory managing administrative, business, personnel, and production activities. Minimum qualifications:

- Education: Bachelor's degree in chemistry or any related scientific/engineering discipline with at least 24 college semester hours in chemistry.
- Experience: Two years laboratory experience.

Laboratory Staff: The laboratory has sufficient personnel, having the necessary education, training, technical knowledge, and experience for their assigned functions.

All personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of his/her particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures, and records management. Specific requirements for training are found in the training SOP QA.5

Some clients or programs may have specific requirements for specific positions. These requirements are specified in SOP QA.5.

5.2 Recruitment Policy

The ASC's recruitment policy is defined by the corporate program. Recruitment is the responsibility of the General Manager and corporate human resources personnel. Orientation training of all new employees includes review of the QAM, Chemical Hygiene Plan, and all SOPs required for the job function.

5.3 Corporate Ethics Policy

Laboratory ethics and ASC's ethics policy are discussed during initial training for new employees. All new personnel receive ethics training and are required to sign an ethics agreement. Ethical standards training is reinforced on an annual basis. All employees are required to sign an ethics agreement following annual training. The corporate ethics policy is posted throughout the laboratory. Any employee found to have knowingly reported data values that are not actual values obtained, or improperly manipulated or intentionally reported dates and times of data analyses that are not the actual dates and times of analyses, is immediately terminated. Any laboratory personnel identifying an accidental or suspected intentional reporting of non-authentic data must report the finding immediately. Information can be provided to the Technical Director, Laboratory QA Coordinator, or Laboratory General Manager, or in cases where anonymity is desired, to the person at Corporate Headquarters designated on the employee bulletin board. The project manager immediately notifies the client if any improper data have been reported.

5.4 Corporate Confidentiality and Propriety Rights

All work is performed in the strictest confidence. During orientation training, new and contract employees are required to review the corporate policy and practices for protecting client confidentiality and proprietary rights. The policy and practices are designed to ensure that information from the laboratory is transmitted only to the appropriate and responsible parties.

5.5 Training

New employees receive all necessary training for their job function. Refresher training is provided for current employees as required for their current job function. Training is performed both on

and off site by members of ASC staff, contractors, equipment manufacturers, academic institutions, or regulatory authorities. Training procedures are detailed in the training SOP QA.5. Off-site training takes place on an as-needed or availability basis. Completed studies are documented and updated in the training files of each employee. Off-site training may include the following:

- Courses taken at local colleges and universities.
- Workshops and seminars conducted by instrument manufacturers, software companies, and national associations specializing in analytical chemistry or laboratory quality assurance.
- Specific training classes for instruments or software purchased at the laboratory.

Personnel provide the Document Control Officer with any attendance information and copies of any certificates earned during such training.

On-site training takes place for all new personnel according to the training procedure SOP. Personnel must demonstrate proficiency in the analytical and/or administrative procedures before independent operation in the job function. On-site training includes the following:

- Training in the QAM for all employees when newly hired and at yearly refresher training.
- Training on appropriate SOPs and all major revisions to those SOPs, including QC requirements.
- Instruction for the trainee performing a procedure by a peer analyst or section supervisor.
- Observation and oversight of the trainee performing a procedure by section supervisor or peer analyst.
- Verification that the trainee demonstrates proficiency in the procedure. Each analyst is required to show demonstration of capability through analysis of four known standards or other means described in SOP A.23 and continuing demonstration of proficiency annually through analysis of a proficiency test

sample, repetition of initial demonstration of capability or other means described in SOP A.23. Other approaches to demonstrating proficiency in tests not amenable to spiking are given in SOP A.23.

5.5.1 Training Records Maintenance

The Document Control Officer is responsible for maintaining the training record files and entering information into a tracking database. Reports from the database provide training summaries by individual, and by SOP. The Document Control Officer notifies appropriate personnel when a revision is finalized for the controlled versions of the documents that will require retraining of all appropriate personnel.

Résumés, job descriptions, and biographies are included in the training record files. Biographies are put in a uniform format by the corporate human resources department and are updated with additional education and experience as needed.

5.6 Safety and Health Policies

All laboratory personnel receive orientation training upon initial employment as well as on-the-job training concerning health and safety issues related to the operations being performed. In compliance with the Occupational Safety and Health Administration (OSHA), ASC conducts safety and health training annually, with a careful introduction to new principles. Personnel have access to the master Chemical Hygiene Plan and are trained in reading and locating the Material Safety Data Sheets (MSDS). Personnel required to manage hazardous waste are trained in safety, legal, and shipping aspects of waste management.

6

Laboratory Facilities

6.1 Facility

The laboratory facility has an area of 25,000 square feet with over 800 linear feet of laboratory benching and over 120 linear feet of fume hood space. The ASC floor plan is provided on Figure 6-1. The laboratory is divided into the following areas: administration and offices; GAC; metals sample preparation; organic sample preparation; metals analysis; HPLC, GC, and GC/MS analysis for volatile and semivolatile compounds; and other laboratory support functions. The sample management office is approximately 1,500 square feet and has a 390-square-foot walk-in cooler. A separate ventilated room is used to store laboratory waste prior to pickup by a licensed waste hauler.

Off-site facilities are used for material storage and file archiving. The warehouse is located behind the laboratory facility and the corporate headquarters is located within four miles of the laboratory facility.

Deionized water from a recirculating reverse osmosis/ion exchange system is piped to all laboratory benches. Gases for laboratory instruments and operations are distributed from a central source to the required areas through piping and manifolds. Laboratory benches have chemical resistant work tops and surface bench-level exhaust grills to remove vapors.

6.2 Security Systems and Environmental Controls

The ASC provides a secure environment for our employees, guests, clients, samples, and analytical data.

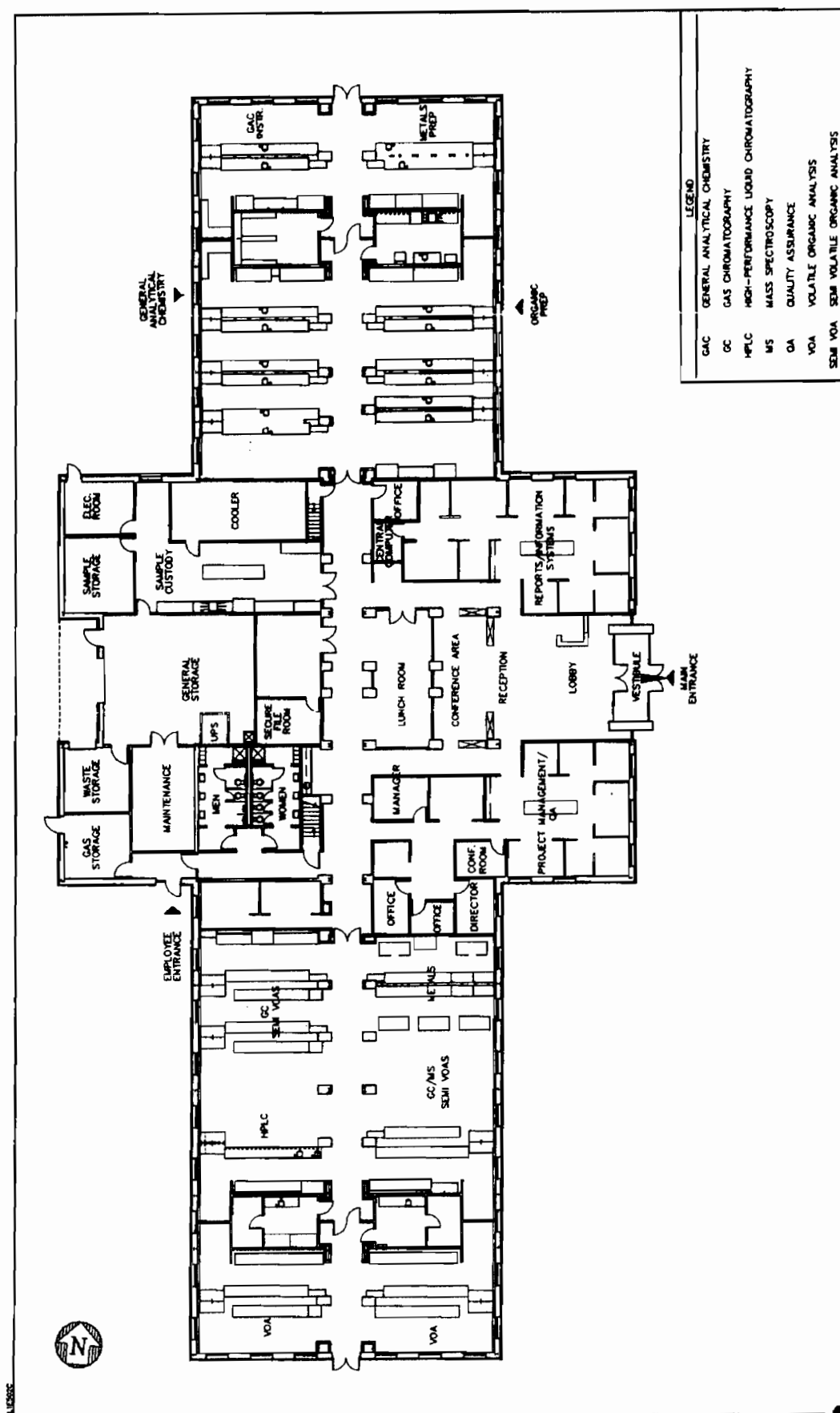


Figure 6-1
 LABORATORY FLOOR PLAN
 ECOLOGY AND ENVIRONMENT, INC.
 ANALYTICAL SERVICE CENTER
 WALDEN AVE. AT RAMSON RD.
 LANCASTER, NEW YORK

6.2.1 Access

To ensure security, all exterior doors remain locked unless directly monitored by personnel. Access to the laboratory is limited to employees and contractors. Visitors not under signed contract to ASC are required to sign the Visitor Log and must be accompanied by an ASC employee.

The sample management area is the defined high security area. Entry into this area is controlled by identification card activated locks on the internal and external entry doors. Personnel not assigned to the high security area must be accompanied by an employee assigned to the area.

The sample reports storage area is defined as a limited access area. Individuals requiring access must get a key from a designated staff member.

6.2.2 Security

All doors are locked after normal business hours and require a card for entry (SOP A.7). The security alarm at ASC continuously monitors for smoke, extreme fire-related heat, cold room temperatures, motion, and door contacts. When the alarm is activated, the appropriate emergency response offices are notified. An emergency contact list is provided to the local emergency offices for contact in case of an emergency.

6.2.3 Archives

Access to the archive facilities is limited to the Laboratory QA Coordinator, Document Control Officer, or personnel designated by them (SOP A.27). The archives include all ASC copies of analytical reports, raw data, inactive logbooks, and other data that facilitate traceability of analytical results that are typically older than one year. Materials housed in the archives are labeled with identification numbers to ensure retrievability. Electronic storage tapes and disks are maintained by the IT Group in fireproof safes.

6.2.4 Environmental Control

Lighting, noise, and other environmental factors at ASC are maintained at appropriate levels. Heating, ventilation, and air-conditioning systems satisfy the needs of the testing being performed. The laboratory building is designed to ensure constant temperature control for analytical equipment. The building has

three completely separate air-handling systems to minimize airborne contaminants that may jeopardize sample integrity. Laboratory activities that involve use of large quantities of organic solvents or inorganic acids are conducted in the northern end of the building, well away from instrument areas.

The working and storage environments are maintained in a safe and appropriate manner. Sample and standard storage areas are monitored and temperature controlled. Separate storage areas are designated for samples, standards, and other identified sources of potential cross-contamination. Sample storage areas for volatiles are separated from other storage areas and monitored for any cross-contamination effects.

Safety measures and equipment which protect personnel and property from injury or illness include: fume hoods, fire extinguishers, fire blankets, alarm systems, safety training, protective clothing, emergency showers, eyewashes, and spill control kits.

6.3 Chemical Storage

All chemicals are stored in appropriate cabinets and are properly disposed of when necessary. All flammable solvents are kept in OSHA and National Fire Protection Association (NFPA)-approved areas. Acids are stored in OSHA-approved areas.

All chemicals, samples, and wastes are accumulated in satellite areas in the laboratory as specified in the waste disposal SOP A.10 and Chemical Hygiene Plan. The samples and wastes are then transferred to the waste storage area. This area is specially designed and separately ventilated to accommodate waste storage prior to proper disposal.

An authorized waste carrier is contracted to pick up waste as needed and dispose of it, in accordance with all regulatory requirements. Post-analysis disposition of samples is dependent upon project-specific requests. Remaining sample material may be returned to the client, safely discarded, or archived for a specific period of time prior to disposal. Section 10.5 defines the specific requirements for sample disposal and other waste disposal operations.

7

The laboratory has an uninterruptible power source (UPS) capable of sustaining power to the instruments and computers for up to three hours in the event of a power failure. The UPS prevents problems caused by fluctuations in the power source.

Equipment and Materials

Accurate analysis consists of setting up proper instrument operating conditions, calibrating instruments, monitoring instrument performance tests, analyzing prepared samples, and collecting data from the analyses. Instrumental analysis procedures, frequencies, and acceptance criteria are described in the test method SOP. The basis for performance criteria, instrument conditions, and the steps of each procedure are derived from EPA or client-specified reference methods.

7.1 Instruments

Analytical instrumentation at ASC includes:

- Gas chromatographs (GC);
- Gas chromatograph/mass spectrometers (GC/MS);
- High performance liquid chromatographs (HPLC);
- Ion chromatographs (IC);
- ICP-atomic emission spectrophotometers;
- ICP/MS;
- UV/visible and infrared spectrophotometers; and
- Flow injection analyzer.

The ASC's major equipment is summarized in Table D-1 in Appendix D. All instrumentation is uniquely identified by an instrument code and serial number.

Regular maintenance procedures and frequency for all equipment are defined in the test method SOP. A stock of spare parts and

consumables are maintained for all analytical equipment. Backup instrumentation for most analytical equipment is available in the event of major equipment failure. The laboratory has a large uninterruptible power source (UPS) capable of sustaining power to the instruments and computers for up to three hours in the event of a power failure. The UPS prevents problems caused by fluctuations in the power source.

Service contracts are maintained for major instrumentation. Service technicians may be called for on-site service of major equipment if routine maintenance operations do not eliminate the problem. Procedures and schedules for preventive maintenance are available in the test method SOPs. All preventative and corrective instrument maintenance is recorded in the logbooks assigned to the equipment. Records of external service are stored in files by the Section Supervisor. Instruments will be tagged as out-of-service until maintenance procedures are completed.

After instrument maintenance or repair, the instruments must be successfully recalibrated following the method SOP. Laboratory personnel must demonstrate acceptable QC performance on the instrument before sample analysis is conducted.

7.2 Instrument Operating Conditions

The reference methods for a given analysis define the instrument operating conditions. In many of the reference methods, a range or general guidance for the operating conditions is defined. The operating conditions may be modified to clarify the reference methods or improve the quality of the results. In all cases where the method is modified, the performance criteria from the reference method must be within the defined acceptance limits. Acceptable modifications to the operating conditions are stated in the method SOP. Any change in the operating conditions not stated in the SOP is documented on a corrective action form. When a change in the operating condition is proven to improve performance for all matrices, the method SOP is revised.

7.3 Computer Systems

E & E maintains an extensive network of computer systems centralized in the corporate headquarters building. The ASC's domain includes an integrated network of standalone instrument computers, instrument data systems, servers, and personal computers.

MB
megabyte

RAM
random access memory

GB
gigabytes

GHz
gigahertz

MHz
megahertz

The GC/MS data system is comprised of two UNIX 10.20 OS Base HP servers. Main system HPB2600/785 workstation with 500 MHz processor, 512 MB RAM and 366 GB total storage. The backup data system is a Hewlett Packard (HP) 9000/735 system with 64 MHz processor, 213 MB RAM, 11 GB of total storage. Both systems are running Target Chromatographic Analysis software by Thru-put and are supported with PC workstations. The GC and HPLC data system is Perkin Elmer Totalchrom Client-server Chromatographic Analysis software running on a Dell Poweredge 4600, 1.2 GHz Xenon processor with 1 GB RAM and 130 GB total storage setup in a RAID 5 configuration. The GC data system supports seven Windows 2000™ workstations. The three PE Optima ICP stand-alone Winlab data systems run on Windows 2000™ workstations. All other instruments operate stand-alone data systems.

Developed in Microsoft Access®, the Laboratory Information Management System (LIMS) is a proprietary customized hybrid of a commercial LIMS product, Khemia Omega II™. The LIMS system is a Microsoft Windows™ based, multi-user Relational Database Management System (RDBMS). This system operates under a modified client/server model. The front-end application runs on a Windows 2000™ Workstation. The back-end database is stored on a Windows NT™ Server with dual 733 MHz Pentium 3 processors. The server is a Dell Poweredge 2400 with 1.5 GB RAM and 180 GB total storage and is set up in a RAID 5 configuration incorporating commercial software to provide automated failover to a redundant comparable server. This configuration provides both software and hardware fault tolerance. Omega II™ provides full-feature, flexible laboratory information management including sample management, work assignment, sample tracking, data reporting, QA, financial planning, and resource allocation. For Contract Laboratory Program (CLP and CLP-like) reporting, ASC runs a combination of customized proprietary CLP reporting modules that are integrated with the LIMS and Target software for

organics analysis and Ward software for inorganic reporting on network PC stations.

In addition to the LIMS, all ASC support software is Microsoft Office 97 running on Windows 2000™. All three servers, 94 PCs, and 27 printers are networked using TCP/IP.

E & E's Corporate Computer Support Center, publications network, graphics, and computer-aided design (CAD) departments also support the ASC. Through these groups, ASC has complete access to the programming and office support software required by clients.

7.4 Sampling Materials

While ASC does not routinely perform sampling, ASC does provide clients with materials needed for sampling upon request. Materials are assembled to meet project-specific requests. The materials provided may include the bottles, blanks, custody form(s), preservatives, and cooler(s) to be used during sample collection. Tables 7-1 and 7-2 list standard containers provided by the ASC. The sample containers or bottles for sample collection are purchased either precleaned, with a certificate of the test results, or precleaned but without a certificate for which ASC then tests lots for contamination. The certificates of analysis are maintained by shipping personnel. The lot numbers, expiration date, and amount of reagent used for sample preservation are recorded and tracked by shipment. Field and trip blanks are preserved with the same reagents as the samples and are tracked by lot number.

Table 7-1 Sample Containers and Volumes for Soil Samples

Type of Analysis	Type and Size of Container	Number of Containers and Filling Instructions (per sample)	Minimum Amount Requested per Test (grams)
Purgeable (volatile) organics	Encore™ or equivalent sampling device	Three per sample. (Sodium bisulfate solution or methanol added at laboratory.)	15 (5 g per device)
	VOA vials with samples kept frozen	Three vials per sample. (Kept frozen until analysis.)	15 (5 g per vial)
	VOA vials with added sodium bisulfate solution or methanol added in field	Three per sample	15 (5 g per vial)
	40-mL glass VOA vial with Teflon™-backed septum or 4-oz. VOA glass jar with Teflon™-lined cap	Two 40-mL or one 4-oz; fill completely, minimal air space.	15
Extractable organics	8-oz. glass jar with Teflon™-lined cap	One; fill completely	50
Metals	8-oz. glass jar with Teflon™-lined cap	One; fill completely	25
General analytical tests	8-oz. glass jar with Teflon™-lined cap	One; fill completely	15

Notes:

All sample bottles are prepared in accordance with generally accepted bottle-washing procedures.

Several types of analyses may be performed on samples from the same container, depending on the sample density and minimum volume requirements.

When project-specific laboratory QC samples are required, a double volume of the sample should be collected and labeled as MS/MSD, or duplicate, etc. Minimum volumes do not include QC samples.

Sample preservation requirements and holding times are presented in Appendix E.

Key:

VOA = Volatile organic analysis.

Materials used for sampling are stored in the warehouse building adjacent to the laboratory building. Reagents for preservation are stored in designated areas to avoid contamination during storage. Trip blanks are prepared as needed in the laboratory volatiles area. All glass containers are packaged to prevent breakage. The containers are placed in plastic coolers, filled with additional packing material, and sealed with tape for shipping.

Table 7-2 Sample Containers and Volumes for Water Samples

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)	Minimum Volume per Test (mL)
Purgeable (volatile) organics	40-mL glass vial with Teflon™-backed septums	Three; fill completely; no air space	40
Extractable organics	0.5-gallon or 1-liter amber glass bottle with Teflon™-lined caps	One 0.5-gallon or 1-liter per test; fill completely	1,000
Metals	1-liter polyethylene bottle with polyethylene-lined cap	One; fill 7/8 full	100
Cyanide	1-liter polyethylene bottle with polyethylene-lined cap	One; fill 7/8 full	50
TOC	40-mL glass vial with Teflon™-backed septum	One	10
Sulfide	1-liter polyethylene bottle	One; fill completely, no air space	200
Acidity, alkalinity, pH, dissolved solids, suspended solids	1-liter polyethylene bottle with polyethylene-lined cap (multiple analyses) all from one bottle)	One; fill completely	500
Hardness	1-liter polyethylene bottle with polyethylene-lined cap	Can take out of metals analysis bottles	100
Chloride	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	10
Sulfate	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	100
Nitrate	1-liter polyethylene bottle	One; fill completely	10
Nitrite	1-liter polyethylene bottle	One; fill completely	10
Total phenol	1-liter amber glass bottle	One; fill completely	50
TOX	1-liter amber glass bottle	One; fill completely, no air space	200
Ammonia-nitrogen	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	200
BOD ₅	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	500
COD	125-mL polyethylene bottle with polyethylene-lined cap	One; fill completely	10
Color	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	50
Fluoride	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	10
TKN	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	100

Table 7-2 Sample Containers and Volumes for Water Samples

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)	Minimum Volume per Test (mL)
Hexavalent chromium	125-mL polyethylene bottle with polyethylene-lined cap	One; fill completely	100
Oil and Grease, HEM	1-liter amber glass bottle	One; fill completely	1,000
TRPH, HEM-SGT	1-liter amber glass bottle	One; fill completely	1,000
Orthophosphate	1-liter polyethylene bottle with polyethylene-lined cap	One; fill completely	50

Notes:

All sample bottles are prepared in accordance with generally acceptable bottle-washing procedures.

Several types of analyses may be performed on samples from the same container depending on the minimum sample volume and preservation requirements.

When project-specific laboratory quality control samples are required, a double volume of the sample should be collected and labeled as a matrix spike/matrix spike duplicate, duplicate, etc. Minimum volumes do not include QC samples.

Sample preservation requirements and holding times are presented in Appendix E.

Key:

BOD₅ = Five-day biochemical oxygen demand.
 COD = Chemical oxygen demand.
 TKN = Total Kjeldahl nitrogen.
 TOC = Total organic carbon.
 TOX = Total organic halogen.
 TRPH = Total recoverable petroleum hydrocarbons.
 HEM = Hexane extractable material.
 HEM-SGT = Hexane extractable material – silica gel treated.

Sample containers are purchased from vendors using EPA-approved glass cleaning procedures. The vendor selection process includes a pre-selection review of qualifications, preparation of a request for quotation, and receipt and review of proposals. Competitive bidders are required to send a series of bottles for testing. The ASC tests a representative subset of containers to ensure product quality prior to awarding contracts. Once a vendor is awarded the contract, the vendor secures large lots of bottles required by the laboratory. Bottles are shipped to the ASC or directly to sampling sites from the lots allocated to ASC.

7.5 Glassware and Glassware Cleaning

Glassware subjected to heat or chemicals are of borosilicate glass. The laboratory also possesses Teflon™ ware for certain tests. Volumetric glassware is Class A.

All glassware used for the preparation of samples is cleaned as described in the SOP for glassware cleaning, A.31, defined for each laboratory preparation area. These procedures include pre-rinses and soapy water washes. The pre-rinse may be solvent, water, or acid solution, depending on the analysis. Glassware is washed with laboratory grade detergents, followed by multiple ASTM Type II water rinses. Cleaning procedures required by specific methods may include solvent, acid, or other rinses. The clean glassware is air dried unless other drying is recommended by the reference test method. The clean glassware is stored in the laboratory area as specified in the reference method or on designated shelves.

Cleaning areas and materials are segregated to avoid cross-contamination. Glassware used for high concentration analyses is kept segregated from glassware used for low concentration analyses. Dedicated glassware is used for volatiles, extractable organic compounds, GAC, and metals analyses.

8

Standards and Calibration

During the analytical process, a variety of measurements are required including volume, weight, concentration, pH, and temperature measurements. The ASC follows established practices as documented in SOPs that ensure the calibration and verification of all equipment and the traceability of standards to national standards of measurement (where available).

8.1 Chemical Standards

The procurement, preparation, handling, storage, and documentation of chemical standards is critical to the analytical process. It is through these chemical standards that reported analyte measurements in samples are traceable to reference values. The ASC uses only quality chemicals as reference materials. Whenever possible, standard solutions must be traceable to national standards, such as National Institute of Standards and Technology (NIST) or NELAP-certified providers.

Preparation of the chemical standards is documented in the method SOP. The documentation requirements for ensuring traceability are defined in the reagent and standard traceability SOP A.28. The procedures describe the management of these analytical standards and the reagents used in preparing the standards. All analysts are trained in the reagent and traceability SOP and are responsible for implementing the procedures.

8.1.1 Sources of Standards, Traceability, and Verification

The ASC purchases chemical standards from approved suppliers. Information about the standards along with any client requirements are recorded in the pertinent standards logbook. The analyst receiving a chemical standard shipment verifies that the information on the standard label is consistent with that on the supplier's certificate or other paperwork. Information about the standard is recorded in a standards logbook. Codes that unambiguously identify

Primary Standard - A neat or concentrated standard received from a supplier. A primary standard is traceable to NIST or verified as equivalent to a certified reference material.

Secondary Standard - A neat or concentrated standard received from a supplier or prepared at a laboratory. The solution's concentration is determined against a primary standard.

Stock Standard - A solution of a standard at a high concentration, used to prepare working standards. These may be prepared in-house or received from a supplier. This standard may be a primary or secondary standard.

Working Standard - A solution of one or more standards or stock standards containing the analyte(s) of interest. The standard is prepared at the concentration defined in the appropriate method SOPs. The working standard is used to directly prepare instrument calibration or sample fortification standards. These may be prepared in-house from primary or stock standards, or purchased from a supplier.

the supplier materials and all derived preparations are also used to trace standard solutions. Non-certified materials are verified against certified reference standards, when certified reference materials are available.

8.1.2 Types of Standards

Analytical methodologies define a variety of QC samples that are used by the laboratory and include: surrogate and matrix spikes, laboratory control samples, internal standards, other QC check standards, and calibration standards. The composition and concentration of these QC samples must conform to method specifications. Standards used to prepare QC samples are categorized at ASC according to primary standard, secondary standard, stock standard, and working standard.

8.1.3 Preparation of Standards

Standard solutions are prepared by experienced analysts and documented in the appropriate standards logbooks. How a standard solution is prepared depends upon the amount required, the concentration required, and the solution's intended application. New standards are prepared at a frequency according to their stability and is specified in the applicable SOP.

All standards are assigned an expiration date. If provided, the supplier's assigned expiration date is used for standard or stock standards, otherwise, the expiration date is assigned based on the date of preparation and the known stability of the analyte. Analytes known to be highly volatile or subject to rapid degradation or reaction are assigned shorter expiration dates. A standard mixture is assigned an expiration date not beyond that of its shortest-lived component.

The expiration date is the date of latest accepted use. Standards are examined for deterioration and evaluated for their contribution to analytical problems during each analytical sequence. The QC parameters for each analysis are designed to monitor the working standards. Standard solutions showing signs of deterioration or with uncertain integrity are replaced immediately, prior to their expiration date.

**ICV
initial calibration
verification**

The initial calibration verification (ICV) solutions are prepared with reference material that is independent of the associated calibration standards. Continuing calibration verifications are from the same source as the calibrations standards.

Laboratory Control Samples (LCS) may be prepared from the same source as calibration solutions or they may be from a second source except where not allowed by specific clients.

8.1.4 Inventory and Storage

Documentation for all standards is carefully kept in relevant standards logbooks. Certificates from the manufacturer are placed in a ring binder. Each certificate includes the code number for the standard. The manner of storage for a standard is determined by its type, expiration date, shelf life, or manufacturer's specifications. All light sensitive standards are stored in amber vials or bottles in designated refrigerators, freezers, or chemical shelves. Analytical standards are never stored together with samples, extracts, or digestates.

8.2 Calibration Procedures and Frequencies

All equipment used for measurement and testing meets the specific requirements of pertinent analytical methods and applicable certification agencies. Calibration procedures and frequencies for specific types of equipment are briefly summarized below. Section 8.3 describes major instruments such as GC/MSs, GCs, HPLCs, and ICPs. Section 8.4 describes support equipment, such as thermometers, analytical balances, pH meters, autopipettors, and volumetric glassware. The specific calibration procedure and frequency are specified in separate SOPs for support equipment or the SOP for the test method using the instrument. Calibration criteria are listed in the method SOP. Except in the rarest of circumstances, the ASC does not report data for any samples unless the performance criteria for initial calibrations are satisfied. If it is necessary to report data, it is appropriately qualified or discussed in the report narrative after approval from the project manager.

Most instrumentation software indicates for each calibration curve, the test method, date, time, analyte, and standard concentrations used and corresponding instrument responses. The time stamp is

set to the network time by the System Administrator. Access is password protected. The software reports the equation of the calibration curve and the correlation coefficient. When the curve is prepared manually, the analyst records these.

The instrumental performance requirements of the published methods and/or manufacturer specifications are followed unless otherwise specified for a project. Other performance tests may also be executed to further demonstrate proper functioning of instrumentation. Any instrument not functioning properly is tagged out-of-service until proper operation is restored. The SOPs for the operation of measurement equipment on the test method contain the following information, as applicable:

- Equipment used in the procedure;
- Calibration procedure, including all formulas and calculations;
- Acceptance criteria for the calibrations, including the accuracy and precision required;
- Corrective action for failed acceptance criteria, including assessment of previous calibration results;
- List of calibration standards;
- Frequency with which the equipment is calibrated, adjusted, and checked; and
- Maintenance of the equipment and record keeping to track performance before and after maintenance.

8.3 Instrumentation

8.3.1 Gas Chromatography/Mass Spectrometry

The GC/MS instrument is tuned prior to performing the initial and continuing calibrations and all sample analyses. Results are required to meet the peak ratio specifications of the analytical methods. For volatiles analyses, bromofluorobenzene (BFB) is used, and for semivolatiles analyses, decafluorotriphenylphosphine (DFTPP) is used.

The GC/MS is calibrated using internal standard techniques by analyzing a set of five or more initial calibration solutions, using procedures specified in the method and SOP.

Calibration criteria are listed in the method SOP. The initial calibration is verified by analysis of a second source standard.

Each day the initial calibration is verified through the analysis of a continuing calibration standard at the start of each analytical batch. The concentration of the continuing calibration standard is dependent on the requirements of the specific method and SOP.

8.3.2 Gas Chromatography and High Performance Liquid Chromatography

External standard calibration is utilized for analysis by GC and HPLC. The method-specified number of calibration standards are used (e.g., generally 5 points) and specified in the SOP. For multiple response components (e.g., polychlorinated biphenyls, toxaphene) the quantitation consists of an average of the quantitated values for selected peaks. Calibration criteria are listed in the method SOP. The initial calibration is verified by analysis of a second source standard (ICV).

Each day the initial calibration is verified through the analysis of a continuing calibration standard (CCV) at the beginning of the analytical sequence and every 20 analyses or less. The concentration of the continuing calibration standard is dependent on the requirements of the specific method and SOP.

Other standard checks may be required for a specified reference method. Instrument performance checks specified in the reference method must be performed and within the acceptance limits stated in the reference method.

8.3.3 Inductively Coupled Plasma – Atomic Emission Spectrophotometry

Initial calibration is performed daily. Initial calibration uses a zero and one non-zero standard. Linear range is verified at low concentration range with a low-level standard. The upper linear range is determined through quarterly studies. Samples are not analyzed until an initial calibration verification has been performed and is found to be within specified range of the true value, depending on

the method. Continuing calibration checks are performed every 10 analyses and at closing.

8.3.4 Inductively Coupled Plasma – Mass Spectrometry

Initial calibration is performed daily using a zero and one non-zero standard. Linear range is verified at low concentration range with a low-level standard. The upper linear range is determined through quarterly studies. Samples are not analyzed until an initial calibration verification has been performed and is found to be within specified range of the true value, depending on the method. Continuing calibration checks are performed every 10 analyses and at closing.

8.3.5 Ion Chromatography

Initial calibration is performed daily using five calibration standards. Continuing calibration verification is performed every 10 analyses. Specifications for acceptable quality control are dependent on the method citation under which the samples are analyzed.

8.3.6 Spectrophotometers

Initial calibration is performed at least every six months using five calibration standards. Continuing calibration standards are analyzed every 10 analyses. Analyses are repeated for quality control standard failures.

8.3.7 Flow Injection Analysis

Initial calibration is performed daily using five calibration standards. Continuing calibration verification is performed every 10 analyses. Specifications for the quality control samples are dependent upon the analyte measured.

8.3.8 Total Organic Carbon Analyzer

Initial calibration is performed daily for aqueous analysis using three calibration standards. Initial calibration is performed at least every six months for solid analysis using three calibration standards. Continuing calibration verification is performed every 10 analyses. Specifications for the quality control samples are dependent upon the method chosen for analysis.

8.3.9 Total Organic Halogen Analyzer

The titration cell is verified to be within specification for the method at the start and after every 10 sample analyses.

8.4 Support Equipment

All support equipment is calibrated according to the SOP used for the analysis. The most common support equipment used in the laboratory are thermometers, balances, pH meters, and conductivity meters. This section provides a general summary of the procedure used for calibration and measurement controls. Other equipment calibration is defined in the test method SOP.

8.4.1 Thermometers

Laboratory thermometers are routinely checked for accuracy against certified, NIST-traceable thermometers following the thermometer calibration procedure. These calibrations are performed annually (SOP A.38). Correction factors derived from the annual calibrations are applied to temperature readings. NIST-traceable thermometers are professionally calibrated and recertified every five years. Records of thermometer calibrations are retained in a logbook in the general analytical chemistry laboratory area. All thermometers are tagged with the thermometer ID number, correction factor to be applied to the measurement, and the expiration date of the calibration check. Thermometers past the calibration expiration date or thermometers not reading properly are not used. Replacement thermometers are calibrated, and the spreadsheet is updated when a change in the thermometer is required due to breakage, damage, or expired calibration.

8.4.2 Balances

Calibration checks are performed for each day of use, for each balance. The calibration consists of a minimum of two weights which bracket the weight to be measured. The balance calibration procedure defines the acceptance criteria and performance criteria for the various balances used in the laboratory. Calibration weight measurements must meet the acceptance criteria listed in the SOP A.19 and balance calibration logbook. Each balance is serviced and calibrated by a certified professional annually. The accuracy of the calibration weights used by ASC is verified each year by an accredited calibration service. Balances are labeled with the balance

number, date of service, and the expiration date for the annual service check. The balance number used for any measurements requiring traceability is recorded with the measurement data. Balances with expired calibrations or that fail the weight check are not used.

8.4.3 pH Meters

The pH meters are calibrated prior to use. The meter is calibrated following the procedure for pH analysis (SOP GAC.34). Records of the calibration are documented in an instrument logbook or in the raw data for the analysis being performed. At least two buffer solutions that bracket the measurement range of the analysis are used for calibration. A check standard is used at the end of the analysis run to verify meter stability.

8.4.4 Conductivity Meters

A five-point calibration curve using potassium chloride (KCl) solutions is analyzed annually. The calibration curve is used to determine the cell constant for the meter. The cell constant from the annual calibration curve is compared to the acceptance criteria defined by the manufacturer. If performance is unacceptable, the cell is cleaned and rechecked. The cell is not used until satisfactory performance is achieved.

A single KCl standard solution is used as a check standard each day the meter is used. The meter is labeled with the expiration date for the annual calibration.

9

Test Methods and SOPs

The ASC is a full service analytical laboratory. Products include the preparation and analysis of a wide variety of sample matrices using standard, approved methods. The draft methods in the reference SW-846 below fall in the category of “any reliable method” and may be used with the understanding of the client. In addition, ASC develops and validates non-routine analytical methods. The ASC’s standard tests are listed in Table E-1 in Appendix E. The ASC’s procedures for validation of new methods are described below.

9.1 Routine Analytical Methods

The ASC utilizes a variety of in-house analytical methods that are based on the most recent versions of EPA or other published methods. In some cases, minor modifications of the reference methodology may be employed. Such modifications are listed in the corresponding SOP. Accuracy, precision, and sensitivity must be within the acceptance criteria of the reference method. Compounds, elements, or parameters to be measured are chosen from the reference methods. Additional compounds, elements, or parameters may be added based on client or project specific requests. Reference methods are utilized from the following references:

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, EPA SW-846, Updates III, IIIA, Drafts IVA and IVB, USEPA, November 2000;
- *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association [APHA]/American Water Works Association [AWWA]), 18th edition, 1992 and 20th edition, 1998;
- *Methods for the Determination of Metals in Environmental Samples*, USEPA, EPA-600/4-91/010, June 1991.

- *Methods for the Determination of Metals in Environmental Samples*, Supplement I, USEPA, EPA-600/R-94/111, May 1994.
- *Methods for the Determination of Inorganic Substances in Environmental Samples*, USEPA, EPA-600/R-93/100, August 1993.
- *Methods for Chemical Analysis of Water and Wastes*, USEPA, EPA-600/4-79-020, March 1983;
- Wastewater testing references cited in 40 Code of Federal Regulations (CFR) Part 136;
- EPA Contract Laboratory Program Statements of Work for Organic (OLM04.3) and Inorganic (ILM04.1 and ILM05.2) Analyses;
- Drinking water testing references cited in 40 CFR Part 141;
- *Methods for the Determination of Organic Compounds in Drinking Water*, USEPA, EPA/600/4-88/039, December 1988, revised July 1991.
- *Methods for the Determination of Organic Compounds in Drinking Water-Supplement I*, USEPA, EPA-600-4-90/020, July 1990.
- *Methods for the Determination of Organic Compounds in Drinking Water-Supplement II*, USEPA, EPA-600/R-92/129, August 1992.
- Environmental Monitoring Systems Laboratory, USEPA, Cincinnati, Ohio 45268.
- *NIOSH Manual of Analytical Methods*, 4th edition, U.S. Department of Health and Human Services, August 7, 1994; January 1998.
- ASTM guidelines; and
- Specialty testing references cited by state regulatory programs.

The test methodologies are listed in Table E-1. An inventory of the ASC SOPs is provided in Appendix F.

SOPs are written for each analytical method as described in the SOP QA.18, Standard Operating Procedures, Use and Administration. Analytical SOPs include a method summary; health and safety concerns; references; interferences; instrumentation and equipment; reagents and materials; preservation and container handling; a detailed description of the procedure including all calculations; data reduction and reporting; QA/QC procedures; routine instrumentation maintenance; and sample disposal. Any special client requirements are listed in a separate section. SOPs are developed, reviewed, and revised according to document control procedures described in Section 11. All SOPs must reflect actual laboratory practice and are used as a training tool for new and existing analysts. SOPs are reviewed annually or biannually according to SOP QA.18, or when the method is revised. All analysts receive training on the major revisions.

9.2 Target Compounds

Most of the organic analytical methods can be used to analyze multiple parameters that are either listed in the method or considered potentially detectable by the analytical technique. The target compounds for the method depend on the specific application or project. For each method, the laboratory maintains a standard target compound list as identified in the individual method SOPs. The standard compound list is made up of the compounds that are analyzed routinely, included in all standards, and used to generate internal control limits and method performance data. The laboratory may add or remove compounds from the method and will generate the QC data for the compound as required for the specific application or project. In some cases, the method SOPs list compounds that ASC has historical data demonstrating the use of the method for that compound.

9.3 Non-routine Analytical Methods

The process of development of non-routine analytical methods includes a literature search and review, development and approval of an experimental approach, testing of analytical techniques, and generation of method performance data such as an MDL or Initial

IPR
Initial Precision and
Recovery is the same as
initial demonstration of
capability.

Precision and Recovery (IPR) studies. Method development studies are conducted under Good Laboratory Practice procedures. Methods are documented in an SOP.

10

Sample Management

10.1 Sample Receipt and Chain-of-Custody

The sample custodian or designee receives all samples. A work order number is assigned to each shipment of samples received from a client. In-house records for a new work order are initiated with a cooler receipt form. The sample chain of custody form is signed by the client and sample custodian when the samples are received at the laboratory. Samples received via overnight courier are signed on the bill of lading. The bill of lading, cooler receipt form, and the sample receipt log are completed for samples delivered by courier (see examples in Appendix B).

The shipping containers, their contents, and accompanying client documentation are examined by the sample custodian. Information about the presence and condition of custody seals, the state of preservation of the samples, and other required information is noted on the cooler receipt form and/or package receipt log (SOP SM.1, SM.2). The USEPA form DC-1 is used for USEPA CLP samples (SOP SM.11). The cooler temperature, along with the presence or absence of ice, is recorded on the cooler receipt form and chain-of-custody (COC), if applicable. The ASC recommends clients include a temperature blank in all coolers. Any discrepancies in documentation or problems with sample condition are noted and immediately brought to the attention of the client via a project manager notification form. The project manager provides the sample custodian with instructions on the processing of samples that are incomplete or missing required information.

The sample custodian logs the samples into the LIMS, and a label for each container is printed. The custodian attaches each barcode label to the appropriate sample container. The following information is recorded for tracking samples: laboratory sample ID, client sample ID, sample matrix, bottle number, and storage location. The sample receipt and handling SOPs describe procedures for sample receipt and log-in, COC, and handling of sample shipment containers provided by clients. All log-in

information is reviewed by a project manager before a sample can be released for analysis.

10.1.1 Sample Acceptance Policy

The ASC only accepts samples that are appropriate for the requested tests, that are accompanied by sufficient documentation, and that pose no abnormal health and safety threats to facilities or employees.

Samples are appropriate for the requested tests if:

- they are in the proper containers,
- the matrix is compatible with the test,
- there is sufficient volume,
- they are properly preserved, and
- they are within hold times.

Documentation is sufficient if:

- the sample is identified correctly;
- the sample location, date, time of collection, and sampler's name are noted;
- labeling is durable (water resistant);
- preservatives added are noted;
- sample type is noted;
- information is legible;
- a COC form or equivalent documentation is used; and
- container contents match the documentation.

A sample is acceptable from a health and safety perspective if:

- it is not from a site with known radioactivity ≥ 2 times background (a counter may be used on suspect samples);
- it is not from a site that contains dioxin or furan compounds in concentrations that will cause health, safety, or disposal problems;
- it is not explosive, shock sensitive, air or water reactive; and
- the outside of the sample container is clean.

It is the responsibility of the sample management staff to note when samples are unacceptable. It is the responsibility of project managers to make final determinations regarding samples, to notify clients, and to make appropriate comments in laboratory reports.

10.2 Sample Preservation and Security

Samples are stored in a secure manner to ensure their integrity. Samples are stored at temperatures that meet the specifications of the methodology, regulatory agencies, and client. Refrigerator temperatures are maintained at required temperatures (2° - 6°C) and monitored regularly. Preservatives, temperatures, holding times, and container storage requirements are listed in Appendix E.

Chemical preservatives are normally added to sample containers in the field at the time of sampling. Acid or base preservation and temperature preservation are checked upon receipt with the exception of preservation for volatile organic compounds, which is checked after analysis. Any differences from laboratory or client-specific requirements are recorded on a project manager notification form, and the client is contacted by the project manager.

Sample storage facilities are located within the sample management area, which is secured by locked doors. Extracts and digestates are stored in designated freezer units or storage cabinets, respectively, in the laboratory analytical areas. Internal procedures and documentation pertaining to sample possession, removal from storage, and transfer are outlined in the sample custody procedure SOP SM.4. Samples are returned to the sample management area after the required sample portion is removed for analysis.

Precautions are taken to ensure that cross-contamination does not occur during sample storage. The volatile storage refrigerator is monitored weekly for volatile compounds via storage blanks. Storage blanks from the volatiles sample storage refrigerator are replaced weekly and the previous blanks removed and analyzed. The storage blank information helps ASC personnel assess potential cross-contamination in the sample storage refrigerator. Additional project-specific storage blanks are used as required.

Temperatures of cold storage areas are monitored using thermometers calibrated to NIST-traceable thermometers and recorded each working day. Min/max or recording thermometers are used to verify cold storage temperatures on non-working days. Walk-in coolers in the Sample Management area are monitored on off-hours electronically by a security company. Corrective action is taken as necessary when temperatures are not within the control criteria. Details regarding sample storage and preservation are provided in the Sample Management SOPs SM.2 and SM.4, and in the temperature check SOP A.43.

10.3 Sample Preparation and Analysis

All sample preparation and analysis procedures employed at the ASC are covered by appropriate SOPs. Samples are prepared and analyzed following the method specified by client requirements and the matrix to be analyzed. Most samples must be prepared and/or analyzed within a method-specified holding time after sampling (see Appendix E). Any exceptions to the specified holding times are subject to the corrective action process and noted in the case narrative.

Holding times listed in the applicable project-specific documents are followed as required. Samples are occasionally received after holding times have expired. A project manager notification form is completed whenever holding times are exceeded. The project manager notifies the client, and the client decides to continue with the analysis or suspend the testing.

The LIMS tracks holding times for applicable analytical methods and helps ensure that all method and client requirements are met.

10.4 Sample, Extract, and Digestates Archiving

The sample custodian and other authorized personnel are responsible for archiving and disposing of raw samples, extracts, and digestates. Raw and prepared samples are not archived or disposed of until all of the designated analyses are complete and resultant analytical data is sent to clients. Samples in storage are retained for at least 30 days after reporting of the results; any samples requiring longer storage are archived. Longer retainage is available on a project-specific basis.

Archive samples are placed in boxes, labeled with the project numbers and disposal date, and retained in a sample archive area for any additional length of time specified by the client prior to disposal. The archive samples may be stored in the refrigerator or at ambient temperature, as specified by the client. Archived samples are disposed of at any time after the predetermined date in accordance with all applicable rules, regulations, and SOPs. Clients are informed of sample disposal procedures and given an opportunity to request exceptions to the routine practices as part of the contract or task order.

10.5 Sample Disposal

It is the policy of ASC to dispose of all samples and waste in accordance with all applicable rules and regulations. The following lists the primary regulations regarding disposal.

Resource Conservation and Recovery Act (RCRA): Regulations pertaining to the Resource Conservation and Recovery Act (RCRA) and its amending legislation are published in 40 CFR 260-299. The regulations pertaining to satellite accumulation are found in 40 CFR 262. Regulations for generators are found in 40 CFR 265. Solid and hazardous waste definitions are located in 40 CFR 260 and 261.

Hazardous Materials Transportation Act (HMTA): The U.S. Department of Transportation (DOT) promulgates regulations under the HMTA in 49 CFR. HMTA regulations cover all hazardous materials (including both hazardous substances and hazardous wastes) and all aspects of their packaging, preparation, identification, and segregation during transportation.

Occupational Safety and Health Act: The Occupational Safety and Health Act (OSH) authorizes OSHA to provide and enforce regulations governing worker safety. OSHA regulations are found in 29 CFR, with many of the sections pertaining to the laboratory found in part 1910 including 1910.120 *Hazardous Waste Operations and Emergency Response*, 1910.1200 *Hazard Communication*, and 1910.1450 *Occupational Exposure to Hazardous Chemicals in Laboratories*.

New York State Requirements: The State of New York has primacy in the area of environmental enforcement under RCRA. The regulations governing generators and storage of hazardous waste are found in Title 6, Conservation, of the State of New York Code of Rules and Regulations (NYCRR).

10.6 Sample Return to Clients

When a client has requested the return of samples, the sample custodian prepares and ships the samples according to the same custody procedures used to originally send the samples, and following any client-specified requirements. Special packaging procedures are implemented to protect the samples during delivery. Packages are delivered by a commercial carrier whose procedures for protecting the samples are beyond the control of the ASC. Clients are informed that a commercial carrier will deliver their samples.

10.7 Sample Loss, Damage, or Unsuitability

Samples or sample containers can be lost, damaged, or deemed unsuitable, for whatever reason, after initial receipt at the ASC. Whenever this happens, the event is recorded by the observer on the project manager notification form. The problem is reported to the project manager who informs the client. Plans for disposition of the affected sample(s) or containers are agreed upon with the client, carried out, and recorded on a corrective action form.

11

Document Control and Records

11.1 Document Control

The ASC controls all documents that directly impact data quality as specified in the document control SOP A.27. This includes, but is not limited to, the QAM, SOPs, checklists, forms, and spreadsheets. Electronic copies of controlled documents are available to all laboratory personnel. Also a hard copy of each document is stamped in green as the control copy and maintained by the DCO. The document control form (see Appendix B for example) provides a hard copy record of all review and approval signatures, and applicable training and implementation dates.

Uncontrolled copies may be made from the control copy for training and operational review or for external use. The procedure for version document control allows for the retention of a previous version for historical information purposes and includes the status of each active or archived document. Archived documents are procedures not currently requested that may be required in the future or are of old procedures that have been revised. Each document and any subsequent revisions must be reviewed and approved by authorized personnel prior to issue.

Every document is assigned a unique identification number that is present on each page of the document and entered on a master list of documents. The revision number, approval date, and page number are also listed on each control copy. All version-controlled documents are assigned an implementation date to clearly indicate when a new version is applicable.

11.2 Records

The laboratory maintains an extensive series of records related to sample tracking, analytical results and support information. Records management encompasses document control, software management, analytical reports, and the LIMS. The types of records the laboratory manages include SOPs, forms, checklists, project

files, analytical reports, electronic media, QA files, LIMS data, instrument maintenance and other logbooks, programs, spreadsheets, and electronic data deliverables. The general procedures for managing records are outlined in the document control SOP A.27, but additional records management information is presented in individual Administrative, QA, Reports, and Computer SOPs. The following sections summarize policy and procedures on some of the major records retained at the laboratory. All records are required to unequivocally reproduce the analytical results reported and provide evidentiary chain of custody. Records are maintained in retrieval format at the laboratory for at least five years. Drinking water records are maintained for at least 10 years.

11.2.1 Standard Operating Procedures

SOPs are documents detailing every repetitive or standard operation performed by the laboratory. The author of each SOP is generally the person most familiar with the topic being addressed. Each SOP is peer reviewed and authorized by management and the QA department prior to distribution and implementation.

The content of each SOP conforms with applicable requirements of analytical methods and certification agencies and is consistent with the good laboratory practice standards. Within these constraints, the content of an SOP may be customized to meet the needs of a particular area of the laboratory. The performance of laboratory operations is subject to audit for compliance with written SOPs. If an SOP is impractical, difficult to follow, or no longer meets laboratory needs, it is revised or replaced.

The process for developing new or revising existing SOPs is documented in the SOP on SOP Administration (QA.18). At a minimum, SOPs are reviewed biannually to ensure they reflect current procedures. Revisions are made to SOPs as necessary to reflect changes in procedures. Interim changes may be made to operations based on the implementation of a corrective action, provided that the corrective action is authorized. Finally, all personnel involved in the process affected by the change are notified of the SOP change. Training is required for all major revisions and new SOPs.

The Laboratory QA Coordinator administers the SOP program, and the DCO is responsible for clerical preparation and distribution of

new or revised SOPs, record keeping, and archiving of replaced and retired SOPs under his/her direction.

11.2.2 Laboratory Notebooks

The DCO issues all logbooks and assigns and records logbook numbers in numerical order (SOP A.27). Completed logbooks are returned to the DCO within one year of completion of use of the logbooks. The logbooks are archived in locked cabinets in the warehouse. The DCO records the logbook's name, inclusive dates of use, disposition (to warehouse), and date of final disposition in the master logbooks. Logbooks may be destroyed after five years (10 years for drinking water records) unless specifically required by the client. Files are destroyed utilizing a local recycling firm.

The DCO maintains a logbook of all personnel with their signature and initials for reference to traceability and authorization/responsibility.

11.2.3 Laboratory Data

Laboratory report records are maintained in a file to prove that adequate QC procedures are being implemented, accountability of the data is maintained, and traceability of analytical results is completed. Accountability means that reported data reflect the sample as it was received, that sample mix-up was avoided, and that the sample was found properly preserved upon receipt. Traceability means that reported data may be reconstructed at a later date. Through proper documentation, the laboratory is able to demonstrate to clients or government agencies that the data quality is what the laboratory reports it to be. Records contain sufficient information to permit the reconstruction of calibrations, sample preparations, and sample analyses. Raw data information includes method identification, sample identification, instrument identification, and reference to operating conditions, date of analysis and analyst signature.

11.2.4 Quality Assurance Records

Quality assurance records at ASC are maintained to prove that the QA system is being effectively applied. Specific procedures for the identification, collection, indexing, filing, storage, maintenance, and disposition of various quality assurance records at ASC are described in the document control SOP A.27. All quality as-

surance records are recorded in permanent (indelible) ink, legible, attributable to those personnel who created them, and protected so they are not adversely affected by an unsuitable environment. They are stored and maintained in a manner that facilitates retrieval for a period of at least five years after completion. Project-specific quality assurance records are available for evaluation by the client or a client representative during the five-year archive period.

11.2.5 Project Files

Project managers maintain project files for all projects with specific requirements that deviate from routine SOPs. Project files may include an SOW, proposal or quotation, contract, client communications, or permit/regulatory requirements. The project documentation provided to specify analytical and QA requirements may be in the form of a QAPP.

QAPPs provide an overview of the way a project, group of projects, or specific analytical program is to be conducted. When provided, a copy of client QAPPs to be used by the laboratory are available in the QA area. Historical copies of outdated QAPPs are retained in the archives by the Document Control Officer to aid historical interpretation of the data.

11.2.6 Archives

The archives are contained in a separate building, locked at all times, with access limited to the Laboratory QA Coordinator, DCO, and their designees. The person retrieving the records must sign and date a logbook held by the DCO. All materials removed from and returned to the archive building must be signed, dated, and remain intact.

State and federal agencies and clients have access to applicable archived documentation as laboratory policy.

All magnetic and hard copies of data, calibrations, equipment maintenance records, calculations, records of original observations, final test results, and any other miscellaneous quality records directly associated with sample analyses are stored in the archives for a minimum of five years after completion of a project.

11.3 Quality Assurance Manual

The Laboratory QA Coordinator is responsible for the publication and distribution of the QAM. The QAM is submitted to management for review and authorization annually. As major changes are implemented in the QA system, the QAM is revised and submitted to management for authorization. The QAM is published and revised with the assistance of laboratory management.

The authorization signatures found on the authorization page signify management review and approval of the QAM. Minor revisions are authorized by the Laboratory QA Coordinator.

The QAM is available electronically to laboratory personnel and so is controlled. The manual may be distributed to an individual, client, or certifying agency by hard copy or electronically. These are uncontrolled since the laboratory has no control over end use. A distribution list is maintained for the manual and those on the distribution list may request revisions be sent as they occur.

Appendices of the QAM are controlled separately from the major text of the document. Resumes are not part of the QAM proper since personnel requirements are often client-dependent and the list of designated personnel will vary. Resumes are sent with the QAM to clients as designated in the document control SOP A.27.

11.4 Software Management

The goals of the software development methodology, existing system validations, and the change control system are to ensure that the software systems perform the required functions accurately, that the users understand how to use the system. This in turn ensures the delivery of accurate, timely data to the client.

The computer systems used at ASC are either procured from E & E's Corporate Computer Services Center or purchased with a specific instrument system. The ASC has a formal process for management of its computer systems that ensures that data transmitted, reported, or manipulated by electronic means are correct and free from errors. The process includes SOPs, hardware/software redundancy and backup, and related ethics policies for computer usage and data handling.

New software is developed according to the computer SOP Comp.5, Data Management. New software includes the development of spreadsheets for use as electronic laboratory notebooks, functionality added/reporting tools for LIMS systems, and other tools using commercial software packages.

Requests for changes to these software systems are identified through flaws in existing documentation or the need to improve system processes. Through the use of the corrective action process (SOP QA.1), final implementation of the change is documented with the software. This documentation provides a complete record of all software and electronic data reporting problems.

System integrity is verified through programs for routine maintenance, protection from unauthorized access, and electronic verification. Routine maintenance, including system backups, is performed on a scheduled basis. The backup process, password system, and access protection are defined in the computer SOPs. This includes virus checking of all network operations as defined by the Corporate Computer Systems Guidelines using industry-leading virus checking software tools. Documentation of all server backups and maintenance operations are retained in the server logbook for the ASC computer network and is retained by the site Regional Computer Coordinator (RCC).

Data integrity relies on all users of computer systems and software to follow ethical practices when entering, manipulating, or reviewing data. These policies are outlined in the laboratory ethics policy (SOP A.34).

12

Reports

12.1 Data Collection and Reduction

Data collection is performed by the analyst, and data reduction is performed by the analyst and data reporting personnel. Data collection and reduction procedures for specific types of analytical methods are described in the Method SOPs. These procedures vary depending on whether data are acquired manually or electronically.

12.1.1 Manually Acquired Data

Manually acquired data may be recorded on data sheets, logbooks, or entered directly into the computer system. All data are immediately recorded in permanent ink by the analyst, and each page is signed and dated. Corrections are made by drawing one line through the error, dating, initialing, and, where appropriate, noting reasons for the correction in the margin. Unused portions of logbook page intentionally left blank are marked with a large "Z," then initialed and dated on the "Z." All logbooks are signed by a peer or supervisory reviewer.

Logbooks are bound, consecutively numbered, and subject to document control. Electronic logbooks are developed for, used in, printed from, and uniquely numbered by the LIMS. When printed, they are maintained in three-ring binders.

The analyst enters all manually acquired data directly into LIMS for reporting or via electronic spreadsheets developed for use with the LIMS. Hand-entered data are checked for transcription errors as part of the data review process. Data processed in the LIMS may be corrected for dilution factor, percent solids, and the correct significant figures.

12.1.2 Electronically Produced Data

Electronically produced data may consist of chromatograms, spectra, data printouts, and raw quantitation reports. The analyst is identified on raw data with signature on the raw data or in a run sequence logbook. Any alterations to the raw data hard copies and computer files are fully documented and clearly attributable to the

person making such alterations. All manual integrations are identified and approved according to SOP A.46 and copied for inclusion in full data packages, with area changes fully documented on the data printouts. No ambiguity is allowed in data system printouts with regard to correspondence between peaks on a chromatogram and analytes of interest. Computer-collected data is reduced to hard copy as soon as possible. The electronic files are safeguarded by a system of backup media to protect against loss of data and programs. Software used for data acquisition and quantitation reports is tested according to written procedures to assure that no data anomalies are present.

Electronically produced data are transferred directly to the LIMS through an instrument interface program, or the data may be hand entered from the instrument printout. All data are checked for accuracy and transcription errors as part of the data review process. Electronically produced data may be corrected for percent solids, dilutions, and significant figures in the LIMS.

12.2 Data Review

Data review is performed by the analyst, the peer reviewer, project manager, and Laboratory QA Coordinator as defined in the data review SOP A.25. At each stage of the analytical process, data are reviewed for completeness, adherence to protocol requirements and project-specific requirements, and documented on appropriate checklists. Results are fully validated; possible compromises of data quality are evaluated; and deviations from protocol requirements are documented. To the greatest extent possible, computer programs are utilized for data reduction. Where manual data manipulation procedures are required, data review includes additional steps to check for transcription errors. If any nonconformances are noted during data review, corrective actions are initiated at the earliest possible opportunity and documented according to the corrective action procedure.

12.2.1 QC Review

The main purpose of the QC review is to determine the extent to which the method and final data meet established requirements. Checklists for appropriate test methods and project requirements reference the QC criteria to be reviewed along with the acceptance criteria. The review is conducted by initial and peer reviewers. All

nonconformances are documented as defined in the corrective action procedure. All exceptions are noted in the case narrative for client review. Checklists or benchsheets are signed and dated to indicate that the QC review is complete. After initial and peer review, the project manager reviews the reported information for consistency with project requirements.

12.2.2 QA Review

Data reviews are performed by the Laboratory QA Coordinator or designee on a random sampling of ASC data reports. The goal is to perform an evaluation of approximately 10% of sample reports. A data report is carefully evaluated for technical, clerical, and administrative accuracy. Primary emphasis is placed on the ability of the data report to meet current SOP requirements. Data audits are comprehensive assessments of the data review process as defined in Section 4.4. Data audits are conducted annually within the scope of the Systems Audit and allow upper level management to identify opportunities for process improvement, evaluate the efficiency of the system, detect inadequate execution of QC procedures, detect potential system deficiencies, and recommend corrective actions.

12.2.3 Data Qualification and Validation

As part of the data review process, ASC may qualify data prior to reporting. For CLP or CLP-equivalent reports, data qualifiers consistent with the CLP SOW are used. For routine reports, the laboratory uses the following qualifiers:

- “ND” – Not detected at the reporting limit or the MDL, dependent upon report requested.
- “J” – Analyte detected below the reporting limit, but above the current method detection limit.
- “B” – Analyte detected in the associated method blank.
- “H” – Value exceeds Maximum Contaminant Level.
- “M” – Matrix spike recovery outside limits.
- “A” – Result by Method of Standard Additions.

- “E” – Value above quantitation limit (high standard).
- “D” – Value from dilution due to matrix or target analyte above high standard.
- “N” – Single column analysis.
- “X” – See case narrative.
- “*” – Recovery outside limits.
- “R” – RPD outside limits.
- “P” – Post spike recovery outside limits.

After the laboratory releases the data, an E & E corporate or client data validation chemist may review the data package. The data validation chemist will evaluate the package for completeness, and the results against the project-specific DQOs and determine the usability of the results. The data validation chemist may add or remove qualifiers from the data as required for the project.

12.3 Data Reporting

Data are reported by analytical method, target analytes identified, and the quantities present. The content of the final report is dependent on the project-specific requirements. At a minimum, all reports include a cover letter, a case narrative, analytical results, signature of the responsible laboratory project manager, the test methods used, dates of sampling and analysis, data qualifiers, and any QC results associated with the samples.

Full data packages may be presented in the latest CLP format or equivalent. CLP format includes a case narrative, standard report forms, and all associated raw data. Customized data packages following RCRA program QC requirements are also prepared. The project-specific checklists for reporting are developed at the start of the project if customized reporting is required that is substantially different than standard report forms. Project-specific acceptance criteria are placed in an electronic file in the LIMS and are used to check the final reported data. Data anomalies are presented in the case narrative. The data are retained through the laboratory network back-up process.

Clients requiring electronic data deliverables (EDD) receive data in the electronic format standard developed by the ASC. If client requirements differ from the ASC standard formats, EDDs may be compiled based on the criteria defined at the start of the project. Details regarding EDD generation are presented in SOP COMP.10, Electronic Data Deliverable Generation.

12.3.1 Data Package Delivery

Data packages (reports) are prepared for delivery by each laboratory and compiled in the respective lab project manager's area according to the reporting SOP Rep.20 and related electronic reporting SOPs. Several different means of reporting are available depending on client needs. In addition to or in place of a paper copy of the report, an exact electronic copy (.pdf file) can be sent via email or on a CD. EDDs can also be burned on the same CD or sent via email. Unless otherwise requested by the client, a paper copy of the data is shipped while the original is retained in the laboratory archive facility to guard against possible loss of original data. Reports are fully paginated prior to copying. The total number of pages in a report is identified. The method of delivery of the data package is specified in the project or contract. Should the shipped data package be lost or damaged during delivery, a copy will be prepared from the original as a replacement. Copies of any electronic submissions are stored on the network should the original files be corrupted or lost during transmission. Results also may be faxed, emailed, or placed on CD-ROM per client requirements.

12.4 Corrections and Additions to Documentation

Additions or corrections to reports already issued are handled according to the following policy. The project manager can request an addition or correction in writing using a "Report Correction Request" form (SOP A.33). The form is given to the appropriate data reporting personnel. The requested change is made in a timely manner and may need to be internally verified with the analyst and peer reviewer and must be approved by the Project Manager. After the change is reviewed by the responsible parties, the reporting area issues the new report to the customer. The case narrative is changed to record the amended report and the reason for the change from the original. The amended report is stored with the original data package for a minimum of five years.

13

Contracting

13.1 Contract Review

For all analytical services provided by ASC, contract review is accomplished through the generation of a written quote or contract. A written quote is utilized for short-term contracts, usually consisting of one analytical project. A written contract is utilized for long-term contracts consisting of multiple analytical projects.

Project managers are responsible for implementing and documenting contract review. Client requirements, including special needs that are not documented in the current SOPs, are defined and documented in the written quote or contract. Section supervisors having expertise in specific analytical services are consulted to ensure that the laboratory can meet special requirements. If it is decided that the special requirements cannot be met, this is discussed with the client, and alternatives may be offered. Information about ASC's capacity and availability is made available to project managers on a regular basis to enable them to make informed decisions regarding contracted delivery times.

Long-term project requirements are added to the affected SOPs in the section "Client Specific Requirements." Short-term project requirements such as one-time task order requirements or purchase orders are communicated by the project manager to the appropriate personnel by the use of work order comment or project comment in the LIMS, project memo, or a data review checklist. This documentation contains the project-specific requirements used by the analyst, peer reviewer, and project reviewer to ensure that all the requirements are met.

13.2 Subcontracted Analyses

Subcontracting may take place when ASC is able to perform only part of the requested analyses, testing capacity is exceeded, instrument failure occurs, analysis is not possible within the required

hold times, or when a specific client request is made. Clients are notified in advance of any work being subcontracted. Notification may be in the form of e-mail, fax memo, proposal, or contract. When the subcontracted analysis is one that ASC has been certified or approved to perform by the client or regulatory agency, the subcontracting lab must have an equivalent certification or approval such as NELAP, USACE, AFCEE, *et al.*

Subcontracting follows the laboratory SOP A.32 on subcontracting. All subcontracted laboratories must be reviewed as outlined in SOP A.32. The review process ensures that the subcontracting laboratory meets all requirements of the contract including appropriate certifications. The ASC subcontracts to laboratories that continue to meet quality objectives for the projects.

Incoming samples that will be subcontracted are subjected to normal sample receipt procedures. The samples are prepared and shipped to the subcontracting laboratory following the appropriate COC procedures. Results are received at ASC and sent to the client or are sent to the client directly by the subcontracted laboratory.

14

Laboratory Procurement

14.1 Purchasing, Receiving, Inspection, Inventory, and Storage

The purchase, receipt, inspection, inventory, and storage of laboratory materials are described in several SOPs. A completed purchase requisition form provides a clear description of the material to be ordered. The specification for the materials used in testing are listed in the test method SOP. This includes, where applicable, a precise identification and reference to any specifications that must be met. Purchase requisitions are prepared by section supervisors or designee and approved by the General Manager. The corporate purchasing department orders the material from an approved supplier (see Section 14.3). Upon receipt of the goods, receiving personnel examine them for damage before signing the bill of lading. Materials and quantities in all shipments are compared with what was ordered, and this information is communicated to purchasing.

All stocked items are stored in the warehouse. Non-stocked inventory is forwarded to the requisitioning person. Reagent materials are recorded in a material receipt log, marked with the date received, and placed in storage so that the older materials are used first.

14.2 Sample Container Purchase

Sample containers are purchased from vendors using EPA-approved glass cleaning procedures. The vendor selection process includes a pre-selection review of qualifications, preparation of a request for quotation, and receipt and review of proposals. The competitive bidders are required to send a series of bottles for testing. The ASC tests a representative subset of containers to ensure product quality prior to awarding contracts. Once a vendor is awarded the contract, the vendor secures large lots of bottles required by the laboratory. Bottles are shipped to ASC or directly to sampling sites from the lots allocated to ASC.

14.3 Vendor Qualification

The ASC personnel select vendors for all materials and supplies impacting data quality. The corporate purchasing department selects vendors for office items and non-critical supplies. The vendor selection process is similar to that used for sample containers. The ASC develops a list of materials as part of a request for quotation, and vendors prepare a proposal based on these materials. The competitive bidders are selected for long-term use. Critical reagents and standards are pre-tested prior to award. For high use solvents and reagents, vendors are required to maintain large lots allocated for ASC's use. The ASC tests all new lots before the existing lot is expended.

The purchase of standards is somewhat different from the purchase of other supplies. In most cases, the laboratory has a reliable source of high quality standards and will continue to use that vendor for long periods. Many standards are ordered as custom mixes. Where possible, standards are traceable to NIST or a NELAP-approved vendor, or other approved certification.

15

Client Service

The ASC recognizes that superior client service is key to laboratory success in today's competitive analytical services industry. The ASC ensures that analytical reports are delivered in the agreed time and format and that the data meet all project-specific quality objectives. The ASC promotes quick response to client inquiries by all staff and encourages staff to pool their expertise and training to offer clients the best analytical approach to meet unique regulatory concerns. To facilitate successful client service, laboratory management assigns a single point of contact—the ASC project manager.

The Project Manager and Account Executives are responsible for providing client service. Project Managers function as the on-site representative for the customer. Project managers along with account executives are responsible for client interactions from the quotation or proposal to the final report and invoice. The project manager and account executives will usually represent the laboratory in all face-to-face meetings with the client. All project managers are experienced in laboratory analyses and possess the technical expertise to review, interpret, and report client-specific chemistry requirements. Project managers and account executives work closely with the Business Manager to maintain schedules and forecast sales. As a group, they are responsible for ensuring that ASC has adequate capacity for each project they manage and the analytical results are reported in a timely manner.

15.1 Project Documentation

The project manager assists with proposals and project planning to ensure that all client requirements for analytical methods, reporting limits, and QC criteria are consistent with the current ASC SOPs and method performance data. The documentation used to specify client requirements may include the initial contract or SOW; project requirements from manuals, meeting notes, or other sources; the original laboratory proposal; contract negotiation notes; a QAPP developed by either the client or the laboratory; or a client

audit report. Contracts from the client are reviewed as described in Section 13.1. A process similar to the contract review process is used to review other project documentation. The project manager is responsible for communicating project requirements to the appropriate staff and reviewing all final reports to ensure that the reports meet the client requirements.

Client requirements are communicated to the laboratory staff in many ways, depending on the type of project. Examples of incorporating project-specific requirements into the laboratory process are as follows:

- A project-specific QAPP is developed as an addendum to the QAM or provided by the client. The QAPP may be distributed and the staff trained in its use.
- Client-specific requirements are added to administrative or method SOPs.
- Client-specific requirements may be incorporated into method data review checklists.
- The project manager notes project-specific requirements in the LIMS.
- The project manager may hold a kick-off meeting to review requirements of the project.
- Project-specific requirements are incorporated into custom test codes and results checked electronically by the LIMS. The LIMS validator report of outside specification QC results are reviewed by analyst and peer reviewers.

The project manager works closely with the client and ASC management to forecast capacity and schedule analytical work. In addition, the project manager facilitates sample bottle orders and sample receipt/processing at the ASC and verifies all sample custody documentation with the appropriate client representative to ensure that the correct sample analyses are performed. During the analytical process, the project manager monitors the sample analyses to ensure that data quality objectives are met and to expedite the preparation of timely reports. The project manager provides a final review of all analytical reports.

15.2 Client Concern Resolution

All problems or non-conformance with client requirements are handled through the corrective action process described in Section 4.5. The corrective action process requires the project manager to be notified immediately of any non-conformance with the samples or data. The project manager is responsible for informing the client. Depending on the situation and the client, the project manager will document the problem in the case narrative, or notify the client immediately and document the problem in the narrative.

If the client raises concerns after receiving the analytical report, those concerns are addressed as part of the corrective action process. All client inquiries should be addressed within 48 hours of receipt. If follow-up reports or analysis is required, the laboratory will proceed to complete the tasks with the highest possible priority. Long-term client concerns will be tracked as part of the corrective action process. The status of client concerns are reported to laboratory management by the QA Coordinator. A record of all inquiries and their resolution is maintained with the corrective action form in the QA files or in the project files.

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A

Definitions

The following definitions are used in the QAM or related SOPs. The following references were used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, EPA SW-46, New York State Department of Health Environmental Laboratory Approval Program, definitions developed by NELAC and/or the ASC QA Unit. The source of each definition is noted.

Acceptable Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: the process by which an agency or organization evaluates and recognizes a program of study or an institution as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. (NELAC)

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Batch: a group of samples which behave similarly with respect to the sampling or testing procedures being employed which are processed as a unit, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 samples of the same matrix which are prepared together. An **analytical batch** is composed of prepared samples (extracts, digestates, or concentrates) which are analyzed together as a group. (EPA SW846, ASC)

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage, or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct

routine analytical results. (ASQC, Definitions of Environmental Quality Assurance Terms, 1996)

Blind Sample: a subsample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample components (analytes) but not its concentration. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibrate: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration: the set of operations which establishes, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, or values represented by a material measure, and the corresponding known values of a measurement. (VIM - 6.13)

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: defined technical procedure for performing a calibration such as internal standard or external standard. Internal standard calibration is typically used for GCMS methods. External calibration is used for most other methods. (NELAC, ASC)

Calibration Standard: a solution prepared from the primary dilution standard solution or stock standard solutions and the internal standards and surrogate analytes. The calibration solutions are used to calibrate the instrument response with respect to analyte concentration. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody: an unbroken trail of accountability that documents the physical security of samples, data, and records. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Confirmation: verification of the presence of a component through the use of an analytical technique that differs from the original method. These may include:

Second column confirmation,
Alternate wavelength,
Derivatization,
Mass spectral interpretation,
Alternative detectors, or
Additional cleanup procedures. (NELAC)

Continuing Calibration Verification: analysis of a calibration standard to verify the validity of the daily calibration during and at the end for each analytical batch or sequence. (ASC)

Continuing Demonstration of Capability (CDOC): an annual test by the analyst to demonstrate continued ability to generate acceptable data for a testing procedure. Various options exist for this demonstration (NELAC).

Corrective Action: action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Quality Objectives: A statement of the overall level of uncertainty that a decision-maker is willing to accept in results derived from environmental data. (EPA/QAMS)

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collating the data into a more useful form. (NELAC)

Data Validation: The process of evaluating the available data against the project DQOs to make sure that the objectives are met. (EPA SW-846)

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC, Definitions of Environmental Quality Assurance Terms, 1996)

Double Blind Sample: a sample submitted to evaluate performance with concentration and sample components (analytes) unknown to the analyst. In the usual sense, the double blind is also unknown to the laboratory as being a proficiency test sample. (NELAC)

Holding Times (Maximum Allowable Holding Times): the maximum times that samples may be held prior to preparation and analysis and still be considered valid. (40 CFR Part 136)

Initial Calibration Verification: analysis of an independent calibration standard to verify the validity of the initial calibration curve for each analytical batch. (ASC)

Initial Demonstration of Capability (IDOC or IDC): procedure to establish the ability of the analyst to generate acceptable accuracy and precision which is included in many of EPA's analytical methods. In general, the procedure includes the addition of a specified concentration of each analyte into each of four separate aliquots of laboratory pure water or analyte-free solid matrix. These are carried through the entire analytical procedure, and the percentage recovery and the standard deviation are determined and compared to specified limits. (NELAC, 40 CFR Part 136, EPA SW-846)

Initial Precision and Recovery: same as Initial Demonstration of Capability. (ASC)

Instrument Blank: a clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Internal Standard: a known amount of standard added to a test portion of a sample and carried through the entire measurement

process as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

Laboratory Control Sample: a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC)

Matrix: the component or substrate that contains the analyte of interest. For purposes of batch determination, the following matrix types shall be used:

- Aqueous: Any aqueous sample excluded from the definition of a drinking water matrix or Saline/Estuarine source. Includes surface water, groundwater and effluents.
- Drinking water: Any aqueous sample that has been designated a potable or potential potable water source.
- Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous liquid: Any organic liquid with <15% settleable solids.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.
- Chemical Waste: A product or by-product of a industrial process that results in a matrix not previously defined.
- Air Samples: Media used to retain the analyte of interest from an air sample such as sorbent tubes or summa canisters. Each medium shall be considered as a distinct matrix.
- Wipes: gauze. (Quality Systems)

Matrix Duplicate: an intralaboratory split sample which is used to document the precision of a method in a given sample matrix. (EPA SW-846)

Matrix Spike (spiked sample, fortified sample): prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Matrix Spike Duplicate (spiked sample, fortified sample duplicate): a second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

May: permitted, but not required. (TRADE)

Method Blank: a clean sample processed simultaneously with and under the same conditions as samples containing an analyte of interest through all steps of the analytical procedures. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Method Detection Limit (Analytical Detection Limit): the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136 Appendix B)

Must: denotes a requirement that must be met. (Random House College Dictionary)

NELAC: National Environmental Laboratory Accreditation Conference. A voluntary organization of state and federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. (NELAC)

NELAP: the National Environmental Laboratory Accreditation Program of NELAC. (NELAC)

Performance Audit: the routine comparison of independently obtained quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS): a set of processes wherein the data quality needs, mandates, or limitations of a program or project are specified and serve as criteria for selecting appropriate methods to meet those needs in a cost-effective manner. (NELAC)

Performance Evaluation (PE) Sample: see Proficiency Test Sample.

Practical Quantitation Limit (PQL): the limit typically reported for the method that is above the MDL. The ability to reach the PQL should be documented with each analytical batch, typically by using the lowest standard of a verified calibration curve at the PQL. (ASC)

Precision: the degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Preservation: refrigeration and/or reagents added at the time of sample collection to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. Same as Performance Evaluation Sample. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Proficiency Testing: Determination of the laboratory calibration or testing performance by means of interlaboratory comparisons. (ISO/IEC Guide 2 - 12.6, amended)

Pure Reagent Water: shall be ASTM Type I or Type II water in which no target analytes or interferences are detected as required by the analytical method.

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or serv-

ice so that it meets the needs of users. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Quality Control Sample: an uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Quality Manual: A document stating the quality policy, quality system and quality practices of an organization. This may also be called a Quality Assurance Plan or a Quality Plan. (NELAC)

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-41994)

Range: the difference between the minimum and the maximum of a set of values. (NELAC)

Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media (including dictated observations), and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data, and verified accurate by signature), the exact copy or exact transcript may be submitted. (NELAC)

Reagent Blank (method reagent blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Reagent Grade: Analytical reagent grade or related terms which conform to the specifications of the Committee on Analytical Reagents for the American Chemical Society. (EPA SW-846)

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or the assignment of values to materials. (ISO Guide 30 - 2.1)

Reference Sample: prepared by spiking a known amount of analyte into an appropriate solvent. The concentrate or quality control sample preferably should be obtained from an independent source. A sample prepared in-house may be used if it is prepared independently of the calibration standard. (NYSDOH ELAP)

Replicate Analyses: the measurements of the variable of interest performed identically on two or more subsamples of the same sample within a short time interval. (NELAC)

Sample Delivery Group (SDG): a group of samples received for the same project, site, and/or client within a maximum two-week period that are reported together in a single data package. An SDG typically consists of multiple work orders or sample log-ins and is often designated by the client. (ASC)

Sample Duplicate: two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Secure Storage Area: an area of the laboratory with access limited to essential personnel, trained in the function of retrieving samples or information from the area. (ASC)

Selectivity: the capability of a method or instrument to respond to a target substance or constituent in the presence of nontarget substances. (Analytical chemistry)

Sensitivity: the capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification as long as the requirement is fulfilled. (Style Manual for Preparation of Proposed American National Standards, American National Standards Institute, eighth edition, March 1991)

Should: denotes a guideline or recommendation whenever non-compliance with the specification is permissible. (Style Manual for Preparation of Proposed American National Standards, American National Standards Institute, eighth edition, March 1991)

Standard Additions: The practice of adding a known amount of an analyte to a sample immediately prior to analysis. It is typically used to evaluate interferences. (EPA SW-846)

Standard Operating Procedures (SOPs): a written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Spike: a known mass of target analyte added to a blank sample or subsample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Split Sample: aliquots of sample taken from the same container and analyzed independently. In cases where aliquots of samples are impossible to obtain, field duplicates samples should be taken for the matrix duplicate analysis. These are usually taken after mixing or compositing and are used to document intra- or interlaboratory precision. (EPA SW-846)

Standard Reference Material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology and characterized for absolute content, independent of analytical method. (NELAC)

Surrogate: a substance with properties that mimic the analyte of interest. Surrogates (often deuterated) are unlikely to be found in environment samples and are added to samples for quality control purposes. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Systems Audit: a thorough, systematic, on-site qualitative review of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (NELAC)

Temperature Blank: usually a 40-mL VOA vial filled with water sent with a shipment that is clearly marked "Temp Blank." The temperature blank is used to establish the temperature of the samples when the cooler is open. The packaging and placement of the vial should be representative of the samples in the container. (ASC)

Test: a technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure.

NOTE: The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2 - 12.1, amended)

Test Method: defined technical procedure for performing a test. (NELAC)

Testing Laboratory: laboratory that performs tests. (ISO/IEC Guide 2 - 12.4)

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards (generally international or national), through an unbroken chain of comparisons. (VIM - 6.12)

Verified Time of Sample Receipt (VSTR): the time the cooler is delivered to the laboratory by the client or independent courier as recorded in the package receipt log. (ASC from EPA CLP)

Work Order: the number assigned to a shipment of samples delivered on the same day for the same project, site, or client. The

job file contains all data associated with the samples in the work order. (ASC)

B

ASC Commonly Used Forms

ANALYTICAL SERVICES CENTER DOCUMENT CONTROL FORM

Document Title:

Assigned Reviewer:

SOP, Checklist, Form, Spreadsheet:

Current Revision No.:

Peer Reviewer:

Method

Final Revision No.:

QA Review:

R. Piccione / F. Lindauer

Notes: (i.e., reactivated)

Management Review:

G. Hahn / A. Laffin / C. Wojtowicz

REVIEW SCHEDULE

	Draft Reviewed	Date Reviewed	Final Approved	Date Final
Reviewer				
Peer Reviewer				
QA Review				
Management Review				

MINOR REVISION APPROVALS

Comment	QA Authorization/Date	Date Revision Issued	Comment	QA Authorization/Date	Date Revision Issued

PRODUCTION INFORMATION (To Be Completed by Document Control Officer)

Training Required: Yes	No	Date Training Complete:	Assigned Implementation Date:
Date Archived:		Date Destroy:	Special Instructions:

Corrective Action Form		Tracking Number:		
Section 1 INITIATION	Originator:	Start Date:	Method:	Matrix:
	Work Order Number:	Sample Numbers:		
	Client:	Section Where Nonconformance Took Place:		
	How was the Nonconformance Found?			
	☐ Data Review ☐ External Audit ☐ Client Review ☐ Analysis ☐ Internal Audit ☐ PE ☐ SOP ☐ Other			
	Describe the Nonconformance:			
Forward original to the DCO				
Section 2 Corrective Action	Describe the Cause of the Nonconformance and the Corrective Action Taken:			
Forward to DCO				
Section 3 Review	Additional Corrective Actions/Follow-up Comments:			
Forward to DCO				
Section 4 QA	Follow-up Comments:			
QA Classification: ☐ Hold Times ☐ Surr. Recovery ☐ Sample ☐ Documentation ☐ Technique/Process ☐ Equip/Materials ☐ Spike Recovery ☐ Personnel ☐ Calibration, initial ☐ LIMS ☐ Blank ☐ LCS Recovery ☐ Reporting ☐ Calibration, continuing ☐ Field ☐ Other:				



PROJECT MANAGER NOTIFICATION

Originator: _____ Date: _____

ASC Project Manager: _____ Client: _____

Job Nos: _____

Sample Nos.: _____

Nature of Concern:

Samples warm @ _____ C

Containers broken. List: _____

Discrepancy between sample containers and COC form

Incorrect or insufficient preservation

Headspace in volatile vials (waters samples only)

Lost shipment: _____

Other (e.g., leaking container, unreadable label, COC form): _____

Further Description: _____

PROJECT MANAGER FOLLOW-UP

Notified Client: _____ on _____ (Date)

Notification attempted:

Means: _____ on _____ (Date)

Notification unnecessary

Notify Sample Management

Action: _____

Project Manager Signature _____

Date _____

C

Laboratory Certifications and Accreditations



LABORATORY CERTIFICATIONS AND ACCREDITATIONS



Source	Issuing Agency	Description of License, Registration or Certification	License, Registration, Certification Number	Scope of Evaluation	Renewal Date
United States Army Corps of Engineers	HTRW Center of Expertise, Omaha District	Solid and hazardous waste and water for organics and inorganics by EPA RCRA methods.	N/A	PT Samples, Audit, QA Manual	1/3/05
United States Air Force	Air Force Center for Environmental Excellence (AFCEE)	Solid and hazardous waste for organics and inorganics based on AFCEE requirements.	N/A	Audit	Updated by project
United States Environmental Protection Agency	Office of Ground Water and Drinking Water Technical Support Center	Unregulated Contaminant Monitoring Rule (UCMR) Perchlorate approval.	N/A	None	1/28/05
Alaska	Department of Environmental Conservation	Underground Storage Tank Program.	UST-024	PT Samples	3/18/05
Arizona	Department of Health Services	Solid and hazardous waste for organics and inorganics.	AZ0645	PT Samples Audit	7/16/05
Arkansas	Department of Environmental Quality Laboratory Certification Program	Soils and waters for organics and inorganics.	N/A	PT Samples, Audit, QA Manual	6/29/05
California	Department of Health Services	Solid and hazardous waste for organics and inorganics; waste extraction test.	1766	PT Samples, Audit	6/30/06
Connecticut	Department of Public Health	Potable, wastewater, and solid waste/soil for organic and inorganic chemicals.	PH2045	PT Samples	12/31/04



LABORATORY CERTIFICATIONS AND ACCREDITATIONS



Source	Issuing Agency	Description of License, Registration or Certification	License, Registration, Certification Number	Scope of Evaluation	Renewal Date
Florida	Department of Health	Wastewater and solid and hazardous waste for organics and inorganics.	E87037	NELAP (PT Samples, Audit)	6/30/05
Illinois	Environmental Protection Agency	Wastewater and hazardous wastes analysis for organics and inorganics; potable water analysis for volatiles.	200042	NELAP	12/31/04
Indiana	Department of Health	Drinking Water for Organics and Inorganics	C-NY-01	PT Samples	4/1/05
Iowa	Iowa Department of Natural Resources	Wastewater for organics and inorganics.	371	PT Samples/ New York analytes only	7/1/05
Kansas	Department of Health and Environment	Solid and hazardous waste for organics and inorganics.	E-10157	NELAP	1/31/05
Kentucky	Natural Resources and Environmental Protection Cabinet	Drinking water for organics and inorganics.	90083	PT Samples	12/31/04
Maine	Department of Human Services	Drinking water and wastewater for organics and inorganics.	NY050	PT Samples	10/31/04
Maryland	Department of Health and Mental Hygiene	Drinking water for metals and volatile organics.	290	PT Samples	12/31/04
Massachusetts	Department of Environmental Protection	Potable water for select parameters and non-potable water for organics and inorganics.	M-NY050	PT Samples	6/30/05



LABORATORY CERTIFICATIONS AND ACCREDITATIONS



Source	Issuing Agency	Description of License, Registration or Certification	License, Registration, Certification Number	Scope of Evaluation	Renewal Date
Nebraska	Department of Health and Human Services Regulation and Licensure	Potable water for organics and inorganics.	23511	PT Samples	4/1/05
New Hampshire	Department of Environmental Services	Non-potable water for organics and inorganics.	296804	NELAP	2/5/05
New Jersey	Department of Environmental Protection	Potable water and solid/hazardous waste for organics and inorganics; CLP.	NY792	NELAP	6/30/05
New York	State Department of Health Environmental Laboratory Approval Program	CLP for organics and inorganics by NYSDCE Analytical Services Protocol. Potable/non-potable water, solid/hazardous waste, and air and emissions for organics and inorganics.	10486	NELAP Primary Accrediting Authority (PT Sample, Audit)	4/1/05
North Dakota	Department of Health Chemistry Division	Wastewater and solid and hazardous waste for organics and inorganics.	R-183	PT Samples	6/30/06
Oklahoma	Department of Environmental Quality	General water quality/sludge testing.	9946	PT Samples, QA Manual	8/31/05
Oregon	Environmental Laboratory Accreditation Program	Drinking water, solid and hazardous waste, water/wastewater.	NY200002	NELAP	4/2/05
Pennsylvania	Department of Environmental Protection	Drinking water for volatile organics.	68-519	PT Samples, Audit, QA Manual	7/11/05



LABORATORY CERTIFICATIONS AND ACCREDITATIONS



Source	Issuing Agency	Description of License, Registration or Certification	License, Registration, Certification Number	Scope of Evaluation	Renewal Date
Rhode Island	Department of Health	Potable water, wastewater, and solid and hazardous waste for inorganics; potable water, wastewater, and air for organics.	00279	PT Samples, NY Certification	12/30/05
South Carolina	Department of Health and Environmental Control	Wastewater and solid and hazardous waste for organics and inorganics.	91001	PT Samples	6/30/05
Utah	Department of Health	RCRA: Wastewater and solid and hazardous waste for organics and inorganics. Clean Water Act: Various inorganics and volatiles.	ENE 7166858080	NELAP	4/30/05
Virginia	Department of General Services	Drinking water for organics and inorganics.	00124	PT Samples	6/30/05
Wisconsin	Department of Natural Resources	Wastewater.	9996666030	PT Samples, Audit	8/31/05

Notes:

Audit = Successful completion of on-site audit and response to audit report.
 PE Sample = Successful analysis of a performance evaluation sample.
 QA Manual = Review of Quality Assurance Manual and related documentation by off-site agency.

Key:

CLP = Contract Laboratory Program (EPA).
 HTRW = Hazardous, toxic, and radioactive waste.
 N/A = Not applicable.
 NELAP = National Environment Accreditation Program.
 NYSDEC = New York State Department of Environmental Conservation.
 PT = Performance test sample.
 QA = Quality assurance.
 UST = Underground storage tank.

D

ASC Equipment List



MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
Gas Chromatography/Mass Spectrometry (GC/MS) Sections					
Gas Chromatography/Mass Spectrometer	Agilent 5973N	Samantha	MS: US21854348 GC: US10245155	New	2002
	Agilent 5973N	Robert	MS: US10451581 GC: US10142077	New	2002
	Agilent 5973N	Perry	MS: US10451589 GC: US10142103	New	2002
	Agilent 5973N	Niles	MS: US03950358 GC: 00040707	New	2001
	HP 5973	Molly	MS: US94223198 GC: US00034443	New	2001
	HP 5973	Linus	MS: US81221500 GC: DE00020316	New	1998
	HP 5972	Kim	MS: 3702A03755 GC: US00021815	New	1998
	HP 5972	Jake	MS: 3418A01504 GC: 3336A54308	New	1994
	HP 5972	Iris	MS: 3418A01537 GC: 3336A54309	New	1994
	HP 5971	Hank	MS: 3304A04338 GC: 3235A46020	New	1993
	HP 5970	Gloria	MS: 3004A12528 GC: 2950A27378	New	1989
	HP 9000/735	Unix	6433A00214	New	1994
	Tekmar LSC-2000	NA	91207008	New	1991
	Tekmar LSC-2000	NA	90344013	New	1990
Liquid Sample Concentrators for Volatile Organic Compounds (VOCs)	Tekmar LSC-2000	NA	90088007	New	1990
	Tekmar LSC-2000	Hank	89138003	New	1989
	Tekmar LSC-2000	NA	89133001	New	1989
	Tekmar LSC-2000	Jake	88263003	New	1988
Sampler for VOCs in Water	Tekmar ALS-2032	NA	90344015	New	1991



MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
Samplers for VOCs in Water and Soil	Tekmar ALS-2016	Jake	91189011	New	1991
	Tekmar ALS-2016	NA	90100039	New	1990
	Tekmar ALS-2016	NA	89158005	New	1989
	Tekmar ALS-2016	NA	89158004	New	1989
Purge-and-Trap Unit with Closed System Vial Autosampler and SIM/Spiker for VOCs in Water	O.I. Analytical 4560	Robert	M016460749	New	2002
	O.I. Analytical 4560	Perry	N147460423	New	2002
	O.I. Analytical 4560	Niles	M08460554	New	2001
	O.I. Analytical 4551	Linus	J426460278	New	1994
	O.I. Analytical 4552 Archon Autosampler	Robert	13352	New	2002
Purge-and-Trap Unit with Closed System Vial Autosampler and SIM/Spiker for VOCs in Water and Soil	O.I. Analytical 4552 Archon Autosampler	Perry	13628	New	2002
	O.I. Analytical 4552 Archon Autosampler	Niles	12717	New	2001
	O.I. Analytical 4552 Archon Autosampler	Backup	13446	New	1998
	HP 7683	Molly	US11218273	New	2000
	HP 7683	Kim	US82901662	New	1998
Single Tower Automatic Samplers	HP 7673	Iris	3423A39004	New	1994
	HP 7673	Gloria	3120A27075	New	1993
	HP 7673A	Extra	2546A02638	New	1987
	HP 7683	Samantha	CN24428005	New	2002
System for Automated Air Method Analysis SUMMA® Canister Cleaning Apparatus	Tekmar Autocan	Jake	01019005	Used	2003
Purge-and-Trap Closed Loop Autosampler for VOCs in Water	Dynatech Precision PTA 30	Hank	10413-791D	New	1992



MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
Gas Chromatography (GC) Semivolatiles Section					
GC with Dual Electron Capture Detector (ECD) and HP7683 Twin Autoinjector Towers	HP6890	#5	US00043919	New	2002
GC with Dual Electron Capture Detector (ECD) and HP7673B Twin Autoinjector Towers	HP 6890	#1	US00009536	New	1997
	HP 6890	#2	US00009637	New	1997
GC with Dual FID Detectors and HP 7673A Twin Autoinjector Towers	HP 5890 II	#3	2950A26659	New	1990
	HP 6890	#4	US00002531	Used	2001
GC with Dual ECD Detectors and HP 7673A Single Autoinjector Tower	HP 5890 II	#1	2443A04154	New	1991
	HP 5890 II	#2	3126A36948	New	1991
GC with Dual ECDs and LEAP A200SE Autosamplers	Varian 3400	#2	1852	New	1989
GC with FID	Varian 3400	#5	3547	New	1990
Perkin-Elmer 600 Series LINK Chromatography Interface	Model 610		610 M000 60805	New	2002
	Model 610		7234110014	New	2002
	Model 610		610M01091216	New	2002
	Model 610		3204110070	New	2002
Chromatographic Analysis Data System running on HP Netserver LH Pro 200 with seven HP Vectra Pentium 133 PC Stations	Perkin Elmer (PE) Totalchrom Client Server	NA	NA	New	1997
PE Nelson 900 Series Interface	Model 941A		3341210154		
Parker Bolston Zero Air Generator	Model HPZA-3500		HPZA35000075A	New	2003



MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
Gas Chromatography (GC) Volatile Section					
Liquid Sample Concentrators for VOCs					
	Tekmar LSC-2000		91214006	New	1991
	Tekmar LSC-2000		90135009	New	1990
	Tekmar LSC-2000		91207008	New	1989
	Tekmar LSC-2000		89138001	New	
Samplers for VOCs in Water and Soil	Tekmar ALS-2016		91203007	New	1991
	Tekmar ALS-2016		92006008	New	1990
	Tekmar ALS-2016		90115035	New	1989
	Tekmar ALS-2016		90115033	New	
GC	HP5890 II	#4	3336A54343		
	HP-6890	#3	US00020223		
	Varian 3400	#5	3547		
	Varian 3400	#8	8245	New	1990
	Varian 3600	#7	1117		
Autosampler	Varian 8200			New	1994
Autosampler Heater				New	1994
PE Nelson 900 Series Interface			91221014		
	Model 941A		89144008		
			3155210783		
	Model 970A		7102273184		
	Model 970A		7102273182		
	Model 970A		7102273186		
	Model 970A		7102273194		
	Model 941		7102273187		
	Model 941		1119513262		
O.I. Analytical Detector Controllers (2)	Model 5300		B817553423		
			B306553137		
Lamp Power Supply (2)	Model 4430		C809530576 C813530364		
Tremetrics 1000 Hall Detector			ELCO-1117		



MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
Hydrogen Generators	Whatman Model 75-34NA			New	1996
	Whatman Model 75-34NA			New	1996
	Whatman Model 75-34NA			New	1994
Purge-and-Trap Unit with Closed System Vial Autosampler and SIM/Spiker for VOCs in Water and Soil	O.I. Analytical 4552 Archon Autosampler		12267	New	1998
High Performance Liquid Chromatography (HPLC) Section					
HPLCs with Variable Ultraviolet Detectors and one Fluorescence Detector	HP Series 1050	LC-3	3317A02137	New	1992
	HP Series 1050	LC-1	3405A02859	New	1990
	HP Series 1050	LC-2	3019A00502	New	1990
	HP Vectra	NA	NA	New	1990
Chemstation Operating Systems	HP Vectra	NA	NA	New	1990
Organic Sample Preparation Section					
8-Position Extractor with Soxhlet Extractor Glassware	Organomation ROT-X-TRACT-HP			New	1994
Glassware Washer	National Model NL W-66			New	1994
Gel Permeation/Autoevaporation Concentrator	ABC AS 2000			New	1992
Dual Column Injection/Filtration System for Gel Permeation	OI Autoprep 2000 with UV Detector		B226330236	New	2002
	Zymark BenchMate			New	1995
	Zymark BenchMate			New	1995
Fraction Collectors	ISCO Foxy 200			New	1999
	ISCO Foxy 200			New	1999
	ISCO Foxy 200			New	1999



MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
Turbovap II Concentration Workstation	Zymark	Organic Concentration	TV9904N8595 TV9738N7706 TV9830N8223 TV9904N8591	New	2002
Automated Solid Phase Extraction System	SPE-DEX 4790 Horizon		Controller 030401 Extractor 02-0349, 02-0350, 02-0351, 02-0352	New	2003
General Analytical Chemistry (GAC) Section					
Total Organic Carbon Analyzer/Autosampler	OI Analytical-1010 Autosampler-1051	TOC	J240710346 B250751598	New	2002
Ion Chromatograph	Detector: DX-120 Autosampler: AS40-1	IC	02120021 02070077	New	2003
Ion Chromatograph	Pump 79855A Autosampler Conductivity Cell / Dionex	IC	2840A00181 3019A00490 00090186	New	1987
Electrochemical Anion Conductivity Detector	Dionex ED-40		95010365	New	1996
Spectrophotometer	Milton Roy Spectronic Genesys 5 Milton Roy Spectronic 601		3V05145005 3612105018	New	1994 1990
Infracal Curvette Holder Analyzer TOG/TPH Model CVH with dust cover and power supply	Wilks Enterprise, Inc. 405-0003	IR	010919	New	2002
COD Block Digester	Hach 16500-10		860808219		
Balance – Top Loader	OHAUS Adventurer		E2381200 321686	New	2000
Balance – Analytical	Sartorius LA-1205		11404590	New	2000
Automated Analyzer with Flow Injection Random Sampler and Heat Block	Lachat QuickChem FIA 8000 Series	Lachat	Pump: A82030-125 Autosampler: A81010-223 Main Unit: A83000-1450	New	1999

MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
Total Organic Carbon Analyzer and Solid Sample Module/Autosampler	Shimadzu SSM 5000/5050A/ASI-5000A	TOC	35517410 35801034 37302774	New	1997/2000
Total Organic Halogen Analyzer	Tekmar-Dohrman DX-2000	TOX		Used	2001
BOD Meter	Yellow Springs Instrument Co., Inc., YSI Model 5000		95A27314	New	2000
Turbidity Meter	HF Scientific DRT15C		20873	Field	1992
Cyanide Distillation System, Easy Dist Jr.	Westco Scientific		1157	New	2001
Distillation Unit	Büchi 316		1153	New	2001
pH Meter	Denver Instrument Model 225		685642	New	1994
			K02029	New	1997
			K04852	New	1999
Metals Analysis Section					
Inductively Coupled Argon Plasma (ICP) Spectrometer with Stand-alone Data System	PE Optima 3000 XL	XL	069N4060802 Pump: 7012504 AS-90/AS-91 Controller #3404	New	1994
Mercury Analyzer	Leeman Labs PS 200 II	Leeman	HG-8004	New	1999
Balance	OHAUS Adventurer		E2641200.350125	New	2000
ICP Spectrometer with Dual View Graphics and Stand-alone Data System	PE Optima 3300 DV	DV	069N9122 AS-91 #4184 Neslab Chiller CFT-33 #199315047; Dell Optiplex GXI Computer #B9E3W; Nokia 4472A Plus monitor #A947023607; Pump	New	1999
ICP System with Scott/X-Flow	PE Optima 4300 DV	DV	077N9101801 AS-93 Plus #1499 Neslab Chiller CFT-75 #198028187; Dell Optiplex GX150 Computer #4R40N11; Nokia 4472A Plus Monitor #H005048955; Pump	New	2002



MAJOR LABORATORY EQUIPMENT

Description	Make and Model Number	Designation	Serial Number	Put-in-Use Condition	Year Purchased
ICP-MS System	PE ELAN 9000	ICP-MS	PO900212 AS-93 Plus autosampler #930S3010131; Polyscience Model 3370-PE air-cooled recirculator #G20622; Argon regulator/filter #P10B-01 OA3; Dell 20" computer monitor MX-06D251-47741-2C9-60GY; Dell Optiplex GX260, Pentium 4 CPU 2.0 GHZ, Windows XP #74MH921; HP Laser Jet 4200n printer #USBNP10167	New	2003
Low-Level Mercury Analyzer	Leeman Hydra AF Gold+	Low-Level Mercury	Install No. 62792.	New	2004

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ASC Tests List

ASC Analytical Test List

Test Name	Method No	Matrix	Holding Time (Days)	Bottle Type	Reference
Acids, Inorganic by NIOSH Method 7903	N7903	Air	2	1-L HDPE, Cool 4°C	NIOSH 4th Ed., August 1994
Alkalinity, Total by Method 2320B	SM2320B	Water	14	1-L HDPE, Cool 4°C	Standard Methods, 18th ed., 1992
Ammonia (Nessler) by Method 4500-NH3 C	SM4500-NH3 C	Water	28	1-L HDPE, H ₂ SO ₄ to pH <2, Cool 4°C	Standard Methods, 18th ed., 1992
Ammonia, Nitrogen by Method 4500-NH3.B.E	SM4500-NH3 BE	Water	28	1-L HDPE, H ₂ SO ₄ to pH <2, Cool 4°C	Standard Methods, 18th ed., 1992
Anions by Ion Chromatography by Method 300.0	EPA300.0	Water	2	1-L HDPE, Cool 4°C	EPA 600/R-93/100, August 1993
Anions by Ion Chromatography Method 9056	SW9056	Water Drinking	2	1-L HDPE, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Anions in Drinking Water by Ion Chromatography	EPA300.0	Water	2	1-L HDPE, Cool 4°C	EPA 600/R-93/100, August 1993
Biochemical Oxygen Demand, 5-Day	SM5210B	Water	2	1-L HDPE, Cool 4°C	Standard Methods, 18th ed., 1992
California WET, Extraction for Metals	CWET	Waste	180	250-mL Clear widemouth glass, Cool 4°C	California Title 22 Section 66700
Carbonaceous Biochemical Oxygen Demand, 5-Day	SM5210B	Water	2	1-L HDPE, Cool 4°C	Standard Methods, 18th ed., 1992
Cation Exchange Capacity of Soils by Method 9081	SW9081	Soil	180	125-mL Clear Widemouth, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
CEC Preparation of Soils by Method 9081	SW9081	Soil	180	125-mL Clear Widemouth, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Chemical Oxygen Demand by Method 410.1, 410.2	EPA410.1, 410.2	Water	28	1-L HDPE, H ₂ SO ₄ to pH <2, Cool 4°C	EPA- 600/R-94/111, May 1994
Chemical Oxygen Demand by Method SM5220 C	SM5220 C	Water	28	1-L HDPE, H ₂ SO ₄ to pH <2, Cool 4°C	Standard Methods, 18th ed., 1992
Chloride by Method 325.2	EPA325.2	Water Solid,	28	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Chlorinated Herbicides by Method 8151A	SW8151A	water	40		SW-846 3rd Ed., Update III, June 1997
Herbicide Separatory Funnel Extraction of Waters by 8151A	SW8151A	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Herbicide Sonication of Soils by 8151A	SW8151A	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Chlorinated Phenolics by Method 1653	EPA1653	Water	30		EPA Method 1653 Rev. A, August 1997
Chlorinated Phenolics Separatory Funnel Extraction of Waters by 1653	EPA1653	Water Solid,	30	1-L Amber glass, H ₂ SO ₄ to pH <2, Cool 4°C, Na ₂ S ₂ O ₃ *	EPA Method 1653 Rev. A, August 1997
CLP Mercury Analysis	ILM04.1, ILM05.2	water	28		EPA CLP ILM04.1, ILM05.2
CLP Mercury Preparation of Soils	ILM04.1, ILM05.2	Soil	28	250-mL Clear widemouth glass, Cool 4°C	EPA CLP ILM04.1, ILM05.2
CLP Mercury Preparation of Waters	ILM04.1, ILM05.2	Water Solid,	28	1-L HDPE, HNO ₃ to pH <2	EPA CLP ILM04.1, ILM05.2
CLP Pesticides/PCB by Method OLM04.3	OLM04.3	water	40		EPA CLP OLM04.3
CLP Pesticides/PCB Separatory Funnel Extraction of Waters by OLM04.3	OLM04.3	Water	5	1-L Amber glass, Cool 4°C	EPA CLP OLM04.3
CLP Pesticides/PCB Sonication of Soils by OLM04.3	OLM04.3	Solid	10	8-oz. clear widemouth glass, Cool 4°C	EPA CLP OLM04.3
CLP Semivolatile Organics by Method OLM04.3	OLM04.3	Solid,	40		EPA CLP OLM04.3
CLP Liquid/Liquid Extraction of Waters for SV compounds by OLM04.3	OLM04.3	water	5	1-L Amber glass, Cool 4°C	EPA CLP OLM04.3
CLP Sonication of Soils for SV Compounds by OLM04.3	OLM04.3	Solid	10	8-oz. clear widemouth glass, Cool 4°C	EPA CLP OLM04.3
CLP TAL Metals by Method ILM04.1, ILM05.2	ILM04.1, ILM05.2	Solid,	180		EPA CLP ILM04.1, ILM05.2
CLP TAL Metals ICP Digestion of Soils by ILM04.1, ILM05.2	ILM04.1, ILM05.2	water	180	250-mL Clear widemouth glass, Cool 4°C	EPA CLP ILM04.1, ILM05.2
CLP TAL Metals ICP Digestion of Waters by ILM04.1, ILM05.2	ILM04.1, ILM05.2	Water	180	1-L HDPE, HNO ₃ to pH <2	EPA CLP ILM04.1, ILM05.2
CLP Volatile Organic Compounds in Soils by Method OLM04.3	OLM04.3	Solid	10	40-mL VOA vial, Cool 4°C	EPA CLP OLM04.3
CLP Volatile Organic Compounds in Waters by Method OLM04.3	OLM04.3	Water	10	40-mL VOA vial, HCl to pH <2, Cool 4°C	EPA CLP OLM04.3
Color, Platinum-Cobalt by Method 110.2	EPA110.2	Water	7	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Corrosivity Toward Steel by Method SW1110	SW1110	Waste Drinking	28	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Cyanide, Total by Method 335.4	EPA335.4	Water	14	1-L HDPE, NaOH to pH >12, Cool 4°C	EPA 600/R-93/100, August 1993
Cyanide, Total by Method 335.3	EPA335.3	Water	14	1-L HDPE, NaOH to pH >12, Cool 4°C	EPA 600/4-79-020, March 1993
Cyanide Preparation, Amenable to Chlorination by 335.1	EPA335.1	Water	14	1-L HDPE, NaOH to pH >12, Cool 4°C	EPA- 600/R-94/111, May 1994
Cyanide Preparation, Total by Method 335.3	EPA335.3	Water Solid,	14	1-L HDPE, NaOH to pH >12, Cool 4°C	EPA- 600/R-94/111, May 1994
Cyanide Analysis by ILM04.1, ILM05.2	ILM04.1, ILM05.2	water	12		EPA SOW ILM04.1, ILM05.2
Cyanide Preparation, Total for Soil by ILM04.1, ILM05.2	ILM04.1, ILM05.2	Soil	12	250-mL Clear widemouth glass, Cool 4°C	EPA SOW ILM04.1, ILM05.2
Cyanide Preparation, Total for Water by ILM04.1, ILM05.2	ILM04.1, ILM05.2	Water Solid,	12	250-mL Clear widemouth glass, Cool 4°C	EPA SOW ILM04.1, ILM05.2
Cyanide Analysis by Method 9012A	SW9012A	water	14		SW-846 3rd Ed., Update III, June 1997
Cyanide Preparation, Amenable for Soil by Method 9012A	SW9012A	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Cyanide Preparation, Amenable for Water by Method 9012A	SW9012A	Water	14	1-L HDPE, NaOH to pH >12, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Cyanide Preparation, Total for Soil by Method 9012A	SW9012A	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Cyanide Preparation, Total for Water by Method 9012A	SW9012A	Water	14	1-L HDPE, NaOH to pH >12, Cool 4°C	SW-846 3rd Ed., Update III, June 1997

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Test Name	Method No	Matrix	Holding Time (Days)	Bottle Type	Reference
Cyanide, Amenable to Chlorination by Method 9012A	SW9012A	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Diesel Range Organics (DRO) Analysis by AK102	AK102	Solid, water	40		ADEC UST Proc. Manual App. D Version 3-1-99
DRO Separatory Funnel Extraction of Waters by AK102	AK102	Water	7	1-L Amber glass, Cool 4°C	ADEC UST Proc. Manual App. D Version 3-1-99
DRO Sonication of Soils by AK102	AK102	Solid	14	250-mL Clear widemouth glass, Cool 4°C	ADEC UST Proc. Manual App. D Version 3-1-99
DRO Analysis by Method 8015B	SW8015B	Water	40	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
DRO Liquid-Liquid Extraction of Waters by Method 3520C	SW3520C	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
DRO Sonication of Soils by Method 3550B	SW3550B	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
TPH as Crude Oil Extraction	SW3520C	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
TPH as Crude Oil Extraction	SW3550B	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
TPH as Crude Oil Analysis by GC	SW8015B	Solid, water	40		SW-846 3rd Ed., Update III, June 1997
Florida Petroleum Products	FL-PRO	Solid, water	40		FDEP M for Det. of Pet. Range Organics Nov 1995
Florida Petroleum Products Liquid-Liquid Extraction of Waters by FL-PRO	FL-PRO	Water	7	1-L Amber glass, Cool 4°C	FDEP M for Det. of Pet. Range Organics Nov 1995
Florida Petroleum Products Sonication of Soils by FL-PRO	FL-PRO	Solid	14	250-mL Clear widemouth glass, Cool 4°C	FDEP M for Det. of Pet. Range Organics Nov 1995
TPH by TNRCC, Method TX1005	TX1005	Solid	14	250-mL Clear widemouth glass, Cool 4°C	TNRCC Method 1005 (revised 4/13/98)
TPH by TNRCC, Method TX1005	TX1005	Water	14	40-mL VOA vial, NaHSO ₃ to pH <2, Cool 4°C	TNRCC Method 1005 (revised 4/13/98)
Extractable Petroleum Products by Method OA-2	OA-2	Soil	40		Iowa OA-2
Extractable Petroleum Products by Method OA-2, Soil Extraction	OA-2	Soil	14	250-mL Clear widemouth glass, Cool 4°C	Iowa OA-2
Extractable Petroleum Hydrocarbons by Method OA-2, Water Extraction	OA-2	Water	7	1-L Amber glass, Cool 4°C	Iowa OA-2
Northwest Total Petroleum Hydrocarbons Method NWTPH-Dx	NWTPH-Dx	Water, Soil	40		Manchester Environmental Laboratory Department of Ecology, State of Washington
Northwest Total Petroleum Hydrocarbons Method NWTPH-Dx, Soil Extraction	NWTPH-Dx	Soil	14	250-mL Clear widemouth glass, Cool 4°C	Manchester Environmental Laboratory Department of Ecology, State of Washington
Northwest Total Petroleum Hydrocarbons Method NWTPH-Dx, Water Extraction	NWTPH-Dx	Water	7	500-mL amber glass, HCl to pH <2, Cool 4°C	Manchester Environmental Laboratory Department of Ecology, State of Washington
Gasoline Range Organics (GRO) in Soils by AK101	AK101	Solid	28	40-mL VOA vial, Cool 4°C	ADEC UST Proc. Manual App. D Version 3-1-99
Gasoline Range Organics (GRO) in Waters by AK101	AK101	Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C	ADEC UST Proc. Manual App. D Version 3-1-99
GRO in Soils by Method 8015B	SW8015B	Solid	14	40-mL VOA vial, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
GRO in Waters by Method 8015B	SW8015B	Water	14	40-mL VOA vial, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Volatile Petroleum Hydrocarbons in Water by Method OA-1	OA-1	Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C	Iowa OA-1
Volatile Petroleum Hydrocarbons in Soil by Method OA-1	OA-1	Soil	14	40-mL VOA vial, Cool 4°C	Iowa OA-1
Dissolved Organic Carbon by Method 5310B	SM5310B	Water	28	125 mL HDPE, Filtered, H ₂ SO ₄ to pH <2, Cool 4°C	Standard Methods, 18th ed., 1992
Hardness by Method 2340B (Calculation Only)	SM2340 B	Water	7	1-L HDPE, HNO ₃ to pH <2	Standard Methods, 18th ed., 1992
Hardness, Total by Method EPA 130.2	EPA130.2	Water	180	1-L HDPE, HNO ₃ to pH <2	EPA 600/4-79-020, March 1993
Hexane Extractable Material for Solids	SW9071B	Solid	28	250-mL Clear widemouth glass, Cool 4°C	SW-846 Internet, Rev.2, April 1998
HEM and HEM-SGT for Waters	1664A	Water	28	1-L Amber glass, H ₂ SO ₄ to pH <2, Cool 4°C	EPA-821-R-98-002, February 1999
Hexavalent Chromium by 7196A/3060A	SW7196A	Soil	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Hexavalent Chromium by Method 3500-Cr D	SM3500-Cr D	Water	1	125-mL HDPE, Cool 4°C	Standard Methods, 18th Edition
Hexavalent Chromium by Method 7196A	SW7196A	Water	1	125-mL HDPE, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Hexavalent Chromium by Method NIOSH 7600	N7600	Air	14	High Volume air filter	NIOSH 4th Ed., August 1994
Ignitability (Flashpoint), Liquids by Method 1010	SW1010	Organic	40	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Mercury Analysis in Soil by Method 7471A	SW7471A	Soil	28		SW-846 3rd Ed., Update III, June 1997
Mercury Analysis in Water by Method 7470A	SW7470A	Water	28		SW-846 3rd Ed., Update III, June 1997
Mercury Analysis of Wipe by Method 7471A	SW7471A	Wipe	28	125-mL Clear Widemouth, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Mercury by Method 245.1	EPA245.1	Water	28		EPA- 600/R-94/111, May 1994
Mercury by NIOSH Method 6009	NIOSH 6009	Air	30		NIOSH 4th Ed., August 1994
Mercury Preparation by Method 245.1	EPA245.1	Water	28	1-L HDPE, HNO ₃ to pH <2	EPA- 600/R-94/111, May 1994
Mercury Preparation by NIOSH Method 6009	NIOSH 6009	Air	30	Solid sorbent tube (Hopcalite)	NIOSH 4th Ed., August 1994
Mercury Preparation of Soil by Method 7471A	SW7471A	Soil	28	1-L HDPE, HNO ₃ to pH <2	SW-846 3rd Ed., Update III, June 1997
Mercury Preparation of Waters by Method 7470A	SW7470A	Water	28	1-L HDPE, HNO ₃ to pH <2	SW-846 3rd Ed., Update III, June 1997
Mercury Wipe Preparation by Method 7471A	SW7471A	Wipe	28	125-mL Clear Widemouth, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Metals by ICP by 40 CFR Appendix G	EPA 40 CRR App G	Air	180	High Volume air filter	40 CFR Part 50 Appendix G

ASC Analytical Test List

Test Name	Method No.	Matrix	Holding Time (Days)	Bottle Type	Reference
Digestion of Air Filters by 40 CFR Appendix G	EPA 40 CRR App G	Air Solid	180	37mm Air Cassette	NIOSH 4th Ed., August 1994
Metals by ICP Method 200.7	EPA200.7	Water	180		SW-846 3rd Ed., Update III, June 1997
Digestion for Metals by 200.7	EPA200.7	Water	180	1-L HDPE, HNO ₃ to pH <2	EPA- 600/R-94/111, May 1994
Digestion for Total Recoverable Metals by 200.7	EPA200.7	Water	180	1-L HDPE, HNO ₃ to pH <2	EPA- 600/R-94/111, May 1994
Metals by ICP Method 6010B	SW6010B	Water	180		SW-846 3rd Ed., Update III, June 1997
Metals by ICP-MS Method	SW8020A	Water	180		SW-846 3rd Ed., Update III, June 1998
Metals ICP Digestion of Soils by 3050B	SW3050B	Solid	180	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Metals ICP Digestion of Waters by 3010A	SW3010A	Water	180	1-L HDPE, HNO ₃ to pH <2	SW-846 3rd Ed., Update III, June 1997
Metals ICP Digestion of Wastes by Method 3020A	SW3020A	Water	180	1-L HDPE, HNO ₃ to pH <2	SW-848 3rd Ed., Update III, June 1997
Total Recoverable Metals Digestion by 3005A	SW3005A	Water	180	1-L HDPE, HNO ₃ to pH <2	SW-846 3rd Ed., Update III, June 1997
Metals ICP Digestion of Wipes by 3050B	SW3050B	Wipe	180	125-mL Clear Widemouth, HNO ₃ to pH<2	SW-848 3rd Ed., Update III, June 1997
Metals by ICP Method 7300	N7300	Air	180	37mm Air Cassette	NIOSH 4th Ed., August 1994
Metals ICP Digestion of Air Filters by Method 7300	N7300	Air	180	37mm Air Cassette	NIOSH 4th Ed., August 1994
Metals in Drinking Water Method 200.9	EPA200.9	Drinking Water	180	1-L HDPE, HNO ₃ to pH <2	EPA- 600/R-94/111, May 1994
Metals GFAA Digestion of Waters by 200.9	EPA200.9	Drinking Water	180	1-L HDPE, HNO ₃ to pH <2	EPA- 600/R-94/111, May 1994
Metals in Drinking Water by Method 200.7	EPA200.7	Drinking Water	180	1-L HDPE, HNO ₃ to pH <2	SW-846 3rd Ed., Update III, June 1997
Methylene Blue Active Substances by Method 5540C	SM5540C	Water	2	1-L HDPE, Cool 4°C	Standard Methods, 18th ed., 1992
Nitrate by method 353.2 (Lachat)	EPA353.2	Water	2	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Nitrate/Nitrite by Method 353.2 (Lachat)	EPA353.2	Water	2	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Nitrite by method 353.2 (Lachat)	EPA353.2	Water	2	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Nitroaromatic (Explosives) Analysis by HPLC	SW8330	Solid, water	40		SW-846 3rd Ed., Update III, June 1997
Nitroaromatic (Explosives) Extraction of Waters by SPE	SW8330	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Nitroaromatic (Explosives) Extraction of Soils by Sonication	SW8330	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Nitrocellulose in Solids by Method LF03	ULF03	Solid	40	250-mL Clear widemouth glass, Cool 4°C	Proprietary
Nitrocellulose in Waters by Method LF03	ULF03	Water	7	1-L HDPE, Cool 4°C	Proprietary
Nitroglycerine by HPLC	SW8330	Solid	40	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Non-Purgeable Organic Carbon by Method 5310B	SM5310B	Water	28	125-mL HDPE, H ₂ SO ₄ to pH<2, Cool 4°C	Standard Methods, 18th ed., 1992
Organic Acids Analysis by HPLC	Dietz, Cortellucci, and Singley	Water	40		E.A. Dietz, N.J. Cortellucci, and K.F. Singley, J. Liq. Chromatogr., 16 (15), 3331-3347 (1993)
Organic Acids Preparation	Dietz, Cortellucci, and Singley	Water	14	1-L Amber glass, H ₂ SO ₄ to pH <2, Cool 4°C	E.A. Dietz, N.J. Cortellucci, and K.F. Singley, J. Liq. Chromatogr., 16 (15), 3331-3347 (1993)
Orthophosphate by Method 365.2	EPA365.2	Water	2	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
PAH by Method 8310	SW8310	Solid, water	40		SW-846 3rd Ed., Update III, June 1997
PAH by GCMS SIM Analysis	SIM	Solid, water	40		SW-846 3rd Ed., Update III, June 1997
PAH Liquid/Liquid Extraction of Waters by Method 3520C	SW3520C	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
PAH Separatory Funnel Extraction of Waters by Method 3510C	SW3510C	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
PAH Sonication of Soils by Method 3550B	SW3550B	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Paint Filter Test for Free Liquids by Method 9095A	SW9095A	Waste	28	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
PCB Analysis by Method 8082	SW8082	Solid, water	40		SW-846 3rd Ed., Update III, June 1997
PCB Separatory Funnel Extraction of Waters by Method 3510C	SW3510C	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
PCB Sonication of Soils by Method 3550B	SW3550B	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Percent Moisture	ASTM D2216	Solid	28	125-mL Clear Widemouth, Cool 4°C	ASTM
Perchlorate by Ion Chromatography	EPA 314.0	Water	28	250-mL HDPE or glass, Ambient	EPA NERL ORD November 1999
Pesticide Analysis by Method 8081A	SW8081A	Solid, water	40		SW-846 3rd Ed., Update III, June 1997
Pesticides Separatory Funnel Extraction of Waters by Method 3510C	SW3510C	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Pesticides Extraction from Water by Solid Phase Extraction	SW3535A	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1998
Pesticides Sonication of Soils by Method 3550B	SW3550B	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Pesticide and PCB Analysis by Method 608	EPA608	Water	30		Method 608, 40 CFR, Part 136, Appendix A
Pesticides/PCB Separatory Funnel Extraction of Waters by 608	EPA608	Water	7	1-L Amber glass, Cool 4°C	40 CFR Part 136 Appendix A
Pesticides Extraction from Water by Solid Phase Extraction	Solid Phase Extraction	Water	7	1-L Amber glass, Cool 4°C	40 CFR Part 136 Appendix A

ASC Analytical Test List

Test Name	Method No	Matrix	Holding Time (Days)	Bottle Type	Reference
Petroleum Products by Method 310-13	ASP310-13	Water	40	1-L Amber glass, Cool 4°C	NYSDEC Analytical Services Protocol 10/95 Edition
Petroleum Products ID by Method 310-14	ASP310-14	Organic	40	40-mL VOA vial, Cool 4°C	NYSDEC Analytical Services Protocol 10/95 Edition
pH by Method 9040B	SW9040B	Water	0	125-mL HDPE, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
pH by Method EPA 150.1	EPA150.1	Water	0	125-mL HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
pH by Method EPA 9045C	SW9045C	Solid	0	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Phenols by Method 420.1 (4AAP)	EPA420.1	Water	28	1-L Amber glass, H ₂ SO ₄ to pH <2, Cool 4°C	EPA 600/4-79-020, March 1993
Phenols by Method 9065 (4AAP)	SW9065	Water	28	1-L Amber glass, H ₂ SO ₄ to pH <2, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Phosphorus, Total by Method 365.2	EPA365.2	Water	28	1-L HDPE, H ₂ SO ₄ to pH <2, Cool 4°C	EPA 600/4-79-020, March 1993
Physical Appearance by Method SM2110	SM2110	Solid	28	250-mL Clear widemouth glass, Cool 4°C	Standard Methods, 18th ed., 1992
Reactive Cyanide by Method 9012A-7.3.3	SW7.3.3.2	Solid	28	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Reactive Sulfide by Method 9034-7.3.4	SW7.3.4.2	Solid	28	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Semivolatile Organics by Method 1625	EPA1625	Water	40		USEPA Office of Water 1625 Rev. C, June 1989
Liquid/Liquid Extraction of Waters for Semivolatile Compounds by 1625	EPA1625	Water	7	1-L Amber glass, Cool 4°C, Na ₂ S ₂ O ₃ *	USEPA Office of Water 1625 Rev. C, June 1989
Semivolatile Organics by Method 625	EPA625	Water	40		40 CFR Part 136 Appendix A
Liquid/Liquid Extraction of Waters for Semivolatile Compounds by 625	EPA625	Water	7	1-L Amber glass, Cool 4°C, Na ₂ S ₂ O ₃ *	40 CFR Part 136 Appendix A
Semivolatile Organic Compound Analysis in Tissue by Method 8270C	SW8270C	Tissue	40		SW-846 3rd Ed., Update III, June 1997
Semivolatile Organic Compound Analysis by Method 8270C	SW8270C	Solid, water	40		SW-846 3rd Ed., Update III, June 1997
Liquid/Liquid Extraction of Waters for Semivolatile Compounds by Method 3520C	SW3520C	Water	7	1-L Amber glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Sonication of Soils for Semivolatile Compounds by Method 3550B	SW3550B	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Sonication of Tissue for Semivolatile Compounds by Method 3550B	SW3550B	Tissue	360	Butcher paper wrapped, frozen	SW-846 3rd Ed., Update III, June 1997
Soxhlet Extraction of Solids for Semivolatile Compounds by Method 3540C	SW3540C	Solid	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Solids, Settleable by Method 160.5	EPA160.5	Water	2	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Solids, Total by Method 160.3	EPA160.3	Water	7	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Specific Conductance by Method 120.1	EPA120.1	Water	28	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Specific Gravity by Method 2710F	SM2710F	Water	40	1-L HDPE, Cool 4°C	Standard Methods, 18th ed., 1992
SPLP Extraction for Metals And Organics by Method 1312	SW1312	Waste	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Sulfate by Method 375.4 (Turbidimetric)	EPA375.4	Water	28	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Sulfide by Method 376.1	EPA376.1	Water	7	1-L HDPE, 10N NaOH to pH 9 / ZnAc	EPA 600/4-79-020, March 1993
Sulfide, Soluble by Method 4500-S2-D-B	SM4500-S2-D-B	Water	7	1-L HDPE, 10N NaOH to pH 9 / ZnAc	EPA 600/4-79-020, March 1993
Suspended Particulate Matter by 40 CFR Appendix B	EPA 40 CRR App B	Air	28	High Volume air filter	40 CFR Part 50 Appendix B
TCLP Extraction for Metals and Semivolatile and Volatile Compounds by Method 1311	SW1311	Waste	14	250-mL Clear widemouth glass, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Total Dissolved Solids (TDS) by method EPA 160.1	EPA160.1	Water	7	1-L HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Total Inorganic Carbon by Method 5310B	SM5310B	Water	28	125-mL HDPE, H ₂ SO ₄ to pH<2, Cool 4°C	Standard Methods, 18th ed., 1992
Total Kjeldahl Nitrogen (TKN) by Method 351.3	EPA351.3	Water	28	250-mL Clear widemouth glass, Cool 4°C	EPA 600/4-79-020, March 1993
Total Organic Carbon by method 5310B	SM5310B	Water	28	125-mL HDPE, H ₂ SO ₄ to pH<2, Cool 4°C	Standard Methods, 18th ed., 1992
Total Organic Carbon by Method 9060	SW9060	Water	28	125-mL HDPE, H ₂ SO ₄ to pH<2, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Total Organic Carbon by Method Lloyd Kahn	Lloyd Kahn	Solid	14	250-mL Clear widemouth glass, Cool 4°C	EPA Attachment 6, July 1998
Total Organic Halogens by Method 9020B	SW9020B	Water	28	1-L Amber glass, H ₂ SO ₄ to pH <2, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Total Suspended Solids, Non-filterable Residue	EPA160.2	Water	7	250-mL HDPE	EPA 600/4-79-020, March 1993
Turbidity (Nephelometric) by Method 180.1	EPA180.1	Water	2	125-mL HDPE, Cool 4°C	EPA 600/4-79-020, March 1993
Volatile Organic Halocarbon Compounds by GC Method 601	EPA601	Water	14	40-mL VOA vial, Cool 4°C, Na ₂ S ₂ O ₃ *	40 CFR Part 136 Appendix A
Volatile Organic Aromatic Compounds by GC Method 602	EPA602	Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C, Na ₂ S ₂ O ₃ *	40 CFR Part 136 Appendix A
Volatile Organic Compounds in Water by GC Headspace Analysis	RSK-175	Water	14	40-mL VOA vial, Cool 4°C	USEPA, R. S. Kerr Laboratory
Volatile Organic Compounds by GCMS Method 1624C	EPA1624	Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C, Na ₂ S ₂ O ₃ *	40 CFR Part 136 Appendix A
Volatile Organic Compounds by GCMS Method 524.2	EPA524.2	Drinking Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C, ascorbic acid*	524.2 Rev 4.0 (1992), EPA-600/R-92-129, August 1992
Volatile Organic Compounds by GCMS Method 624	EPA624	Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C, Na ₂ S ₂ O ₃ *	SW-846 3rd Ed., Update III, June 1997
Volatile Organic Compounds in Air by GCMS Method TO-1	EPATO1	Air	14	Sorbent Tube for Volatile Organic Compounds, Tennax	EPA-625/R-96/010b, January 1997
Volatile Organic Compounds in Air by GCMS Method TO-14A	EPATO14	Air	14	SUMMA Canister	EPA-625/R-96/010b, January 1997

ASC Analytical Test List

Test Name	Method No	Matrix	Holding Time (Days)	Bottle Type	Reference
Volatile Organic Compounds in Air by GCMS Method TO-15	EPATO15	Air	30	SUMMA Canister	Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, EPA/625/R-96/010b, January 1999
Volatile Organic Compounds in Air by GCMS Method TO-2	EPATO2	Air	14	Sorbent Tube for Volatile Organic Compounds, Sphero Carb	EPA-625/R-96/010b, January 1997
Volatile Organic Compounds in Soils by GC Method 8021B	SW8021B	Solid	14	40-mL VOA vial, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Volatile Organic Compounds in Soils by GCMS Method 8260B	SW8260B	Solid	14	40-mL VOA vial, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Volatile Organic Compounds in Waters by GC Method 8021B	SW8021B	Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Volatile Organic Compounds in Waters by GCMS Method 8260B	SW8260B	Water	14	40-mL VOA vial, HCl to pH <2, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Volatile Organic Compounds, Encore Samples by GCMS Method 8260B	SW8260B	Solid	14	Encore Sampler	SW-846 3rd Ed., Update III, June 1997
Volatile Organic Compounds, MeOH Extract by GCMS Method 8260B	SW8260B	Solid	14	40-mL VOA vial, Cool 4°C	SW-846 3rd Ed., Update III, June 1997
Water Content by Method D95	ASTM_D95	Organic	28	125-mL Clear Widemouth, Cool 4°C	ASTM
Water Miscibility by Method D1722	ASTM_D1722	Organic	28	250-mL Clear widemouth glass, Cool 4°C	ASTM
Holding time to preparation is from collection except CLP from VTSR.					
*Should only be used in the presence of residual chlorine and should be added in the field.					

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ASC SOP Inventory

ASC SOP INVENTORY

Method	SOP No.	SOP Name
Administrative SOPs		
	A.04	Sample Container, Blank Preparation, and Shipment Procedures
	A.06	pH Control/Pump System Calibration Procedure
	A.07	Security for the ASC
	A.08	Purchasing and Storing Materials for the ASC
	A.10	Waste Disposal
	A.15	Quality Control Testing of Sample Containers
	A.18	Determination of Method Detection Limits
	A.19	Balance Check Procedure
	A.21	Laboratory Water Quality
	A.22	Batch Identification
	A.23	Initial Demonstration of Method Capability for the Laboratory and Analyst; Continuing Demonstration of Method Performance for the Analyst
	A.24	Micropipette Check
	A.25	Data Review Procedure
	A.27	Document Control
	A.28	Traceability of Reagents and Standards
	A.30	Oven Calibration and Use
	A.31	Glassware Cleaning
	A.32	Subcontracting Procedure
	A.33	Project Management
	A.34	Confidentiality/Proprietary/Ethics
	A.36	Electrical Power Outage
	A.37	Laboratory Logbooks
	A.38	Thermometer Calibration
	A.39	Sonic Disrupter Tuning
	A.40	Project Management, Hudson Chromate Project
	A.41	Sample and Laboratory Contamination Minimization Procedure
	A.42	Procedure for Requesting Permission to Dispose State Samples
	A.43	Refrigerator, Freezer, and Oven Unit Temperature Check
	A.44	Evidentiary Chain of Custody Procedures
	A.45	External Proficiency Test Program
	A.46	Manual Integration
	A.47	Laboratory Hood Use

ASC SOP INVENTORY

Method	SOP No.	SOP Name
3580A	A.48	Internal Chain of Custody Procedure
	A.49	Waste Dilution
	A.51	Case Narratives
	A.52	Managerial Review of the Quality System
	A.53	Laboratory Policy on Reanalysis of Quality Control Samples
	A.54	Quality Control of Support Equipment and Materials
	A.55	Laboratory Surveillance of Ethics Standards
	A.56	Maintenance of Gas Cylinders
	A.57	Test Code Maintenance
	A.58	Laboratory Policy Understandings
	A.59	Method Development
Computer SOPs		
	Comp.05	Data Management
	Comp.06	PC Backup, Security, and Recovery
	Comp.10	Electronic Disk Deliverable Generation
Extractions SOPs		
1311, 8081A:3510C	Ext.58	Pesticide Extraction and Concentration of TCLP Extracts by Method 3510C
1311, 8270C:3510C	Ext.31	Extraction and Concentration of TCLP Extracts for Analysis of Semivolatile Compounds
1625:1625	Ext.80	Extraction of Semivolatile Organics in Water by Method 1625 Isotope Dilution
3510C	Ext.92	Extraction of Organic Acids in Water for Subsequent Analysis by HPLC
3520:PAH-SIM	Ext.93	Extraction and Concentration of Water Samples for the Analysis of PAH Compounds
3535A:8081A;8082	Ext.103	Extraction and Concentration of Pesticides and PCB from Water Samples by SPE
3535A:8330	Ext.94	Extraction of Water Samples for Nitroaromatics (Explosives) Using SPE
3620B	Ext.85	Florisil Cleanup
3630C	Ext.97	Silica Gel Fractionation
3640A	Ext.99	GPC for Pesticides
8015B:3510C, 3520C, 3550B, FL-PRO	Ext.30	EPH Extraction and Concentration of Soil and Water Samples
8081A, 8082:3510C, 3520C	Ext.04	Extraction and Concentration of Pesticides and PCB from Water Samples
8081A, 8082:3550B	Ext.19	Pesticide/PCB Extraction and Concentration of Soil Samples by Method 3550B
8151A:8151A	Ext.07	Extraction of Soil and Solid Waste for Chlorinated Phenoxy Acid Herbicides
8151A:8151A	Ext.08	Extraction of Chlorinated Phenoxy Acid Herbicides from Water Samples and Leachates
8270C:3510C, 3520C, 625	Ext.20	Extraction and Concentration of Water Samples for Analysis of Semivolatile Compounds
8270C:3550B; PAH-SIM	Ext.46	Extraction and Concentration of Soil Samples for Analysis of Semivolatile Compounds

ASC SOP INVENTORY

Method	SOP No.	SOP Name
8310:3520C	Ext.13	Extraction of PAH in Water for Subsequent Analysis by HPLC
8310:3550B	Ext.25	Extraction of PAH in Solids for Subsequent Analysis by HPLC
8330:8330	Ext.68	Preparation of Soil Samples for the Subsequent Determination of Nitroaromatics and Nitramines by HPLC
AK102	Ext.48	DRO Extraction/Concentration of Soil or Water Samples – AK102
NWTPH-Dx	Ext.104	EPH Extraction and Concentration of Soil and Water Samples by Method NWTPH-Dx
OLM04.2	Ext.32	Continuous Liquid-Liquid Extraction of Semivolatile Compounds in Water; CLP
OLM04.2	Ext.33	Semivolatile (BNA) Low-Level Extraction of Soils, CLP
OLM04.2	Ext.35	Extraction of Pesticides/PCB from Water Samples; CLP
OLM04.2	Ext.36	Extraction of Pesticides/PCB from Soil Samples; CLP
OLM04.2	Ext.72	Gel Permeation Chromatography Cleanup for Pest/PCB Soils
OLM04.2	Ext.73	Gel Permeation Chromatography Cleanup for BNA Soils
OLM04.2	Ext.81	CLP Semivolatile Medium Level Extraction
SW3540C	Ext.100	Soxhlet Extraction of Fish for Lipids, Pesticides, PCBs, and PAH (SIM)
SW3630C	Ext.102	Silica Gel Fractionation of Fish Extracts
SW3640A	Ext.101	Gel Permeation Chromatography Cleanup of Tissue Extracts for PAH, Pesticides, and PCB
	Ext.70	Extraction Procedure and Special Cleanup for Buffalo Color Samples
	Ext.98	Preparation of Fish Tissue for Analysis
General Analytical Chemistry SOPs		
110.2	GAC.024	Color, Platinum-Cobalt
120.1	GAC.015	Specific Conductance
140.1	GAC.163	Odor
160.1	GAC.037	Total Dissolved Solids (TDS), Filterable Residue
160.2	GAC.038	Total Suspended Solids, Nonfilterable Residue
160.3	GAC.126	Total Solids, Dried at 103-105 C, Total Residue
160.4	GAC.040	Solids, Volatile by Method 160.4
160.5	GAC.039	Solids, Settleable by Method 160.5
180.1	GAC.127	Turbidity (Nephelometric by Method 180.1)
300; 9056; NIOSH 7903	GAC.162	Anion Analysis by Ion Chromatography Using the DX-120
325.2	GAC.075	Chloride by Water Flow Injection
351.3	GAC.04	Total Kjeldahl Nitrogen (TKN) by Method 351.3/TON 4500-Norg C
353.2	GAC.066	Nitrate/Nitrite by Lachat
365.2	GAC.036	Phosphorus, Total
365.2; 4500-P E	GAC.035	Orthophosphate by Method 365.2

ASC SOP INVENTORY

Method	SOP No.	SOP Name
375.4	GAC.125	Sulfate by Method 375.4 (Turbidimetric)
1010	GAC.072	Ignitability (Flashpoint, Liquids Method 1010)
1030	GAC.140	Ignitability of Solids
1110	GAC.133	Corrosivity Toward Steel
1664A	GAC.155	Hexane Extractable Material (HEM; Oil and Grease; Extraction and Gravimetric Water)
2310B	GAC.016	Acidity by Method 2310B
2320B	GAC.017	Alkalinity-Hydroxide, Carbonate, Bicarbonate, and Total By Method 2320B
2340C, 130.2	GAC.027	Total Hardness by EPA Method 2340C
2710F	GAC.041	Specific Gravity and Bulk Density by Method 2710F
3060A	GAC.091	Alkaline Digestion of Soils and Subsequent Hexavalent Chromium Colorimetric Analysis
3500-Ca D	GAC.147	Calcium Hardness by Method 3500-Ca D
3550	GAC.014	Percent Solids
40 CFR 50 APP B	GAC.142	Suspended Particulate Matter - High Volume Method
4500-NH3 C	GAC.141	Ammonia-Nitrogen by Nesslerization
5210B	GAC.011	Biochemical Oxygen Demand (BOD5 and COD5)
5220C	GAC.012	Chemical Oxygen Demand (COD)
5310C/9060 (soil)	GAC.161	Total Organic Carbon by Method 5310C Using O.I. Analytical TOC Analyzer
7196A	GAC.121	Hexavalent Chromium in Water, Colormetric Analysis by 7196A
9012A; 335.2; 335.3; 335.4; ILM04.1, ILM05.2	GAC.065	Total Cyanide Analysis
9012A; 335.3; 335.4; ILM04.1, ILM05.2	GAC.106	Total and Amenable Cyanide in Water and Soil Preparation - MIDI
9020B	GAC.049	Total Organic Halogens
9030B; 9034	GAC.131	Acid Soluble and Acid Insoluble Sulfides, Samples Amendable to Distillation
9034; Ch 7 Sec 7.3.4.2	GAC.130	Reactivity, Sulfide
9040B, 150.1	GAC.034	pH of Water Samples
9041 mod	GAC.165	Soil pH by pH Paper Method
9045C, OLM04.2	GAC.100	Soil pH
9065; 420.2ME	GAC.148	Phenols by 4-AAP (Medium Distillation, Autoanalyzer Analysis)
9071B	GAC.156	n-Hexane Extractable Material (HEM) and Total Petroleum Hydrocarbons (TPH), Total Extractable Material (TEM) and Pentane Insoluble Material
9095A	GAC.092	Paint Filter Liquids Test (Method 9095A)
AOAC 955.01	GAC.157	Calcium Carbonate Equivalence by AOAC Method 955.01
ASTM D2974	GAC.146	Percent Organic Matter
Ch 7 Sec 7.3.3.2	GAC.085	Reactive Cyanide
DOE/HWP-65/R2	GAC.153	Permanganate Water Test

ASC SOP INVENTORY

Method	SOP No.	SOP Name
EPA 530-R-94-036	GAC.154	Neutralization Potential of Solids
314	GAC.149	Perchlorate Analysis by Ion Chromatography
EPA 821/R-91-100	GAC.158	AVS/SEM Distillation/Extraction
ILM04.1, ILM05.2	GAC.118	Total Cyanide in Water Preparation, CLP
ILM04.1, ILM05.2	GAC.119	Total Cyanide in Soil Preparation, CLP
LF03 USATHAMA	GAC.144	Nitrocellulose
Lloyd Kahn	GAC.076	TOC in Sediment and Soil - Lloyd Kahn
NJDEP Mod 3060A/7196A	GAC.139	NJ Alkaline Digestion of Soils; Hexavalent Chromium Colorimetric Analysis of Water and Digestates
SM3500 Fe B	GAC.167	Ferrous Iron by Method SM3500-Fe B, Phenanthroline Method
SM3500-CR D	GAC.082	Hexavalent Chromium, Colorimetric Analysis by Standard Methods SM3500 CR D
SM4500 NH3 B E	GAC.02	Ammonia-Nitrogen by Method SM4500 NH3 B E
SM4500-Cl G; 330.5	GAC.166	Residual Chlorine
SM4500-S2-E, B, 376.1	GAC.043	Sulfide by Method SM4500-S2-E, B
USGS	GAC.164	Hydrophobicity of Soil
	GAC.064	Lachat General Startup Procedure
Gas Chromatography SOPs		
504.1, 8011	GC.49	Analysis of Water Samples for EDB and DBCP by 501.1, 8011
601	GC.16	Purgeable Halocarbon Analysis by Method 601
602	GC.44	Purgeable Aromatic Analysis by Method 602
608	GC.64	Pesticide, PCB or Pesticide and PCB Analysis by Method 608
1311/8151A	GC.21	Analysis of TCLP Extracts for Chlorinated Herbicides by Method 8151A
8015B Mod	GC.83	TPH as Crude Oil by Method 8015B Modified
8015B/AK102	GC.37	Diesel Range Organics by Method 8015B or AK102
8015B, CA LUFT, NWTPH-Gx, OA-1, OA-2, AK-101	GC.27	TPH-Gasoline 8015B, California LUFT, and NWTPH-Gx
8015B-Mod	GC.87	Kuwait TPH Profile
8021B	GC.59	Volatile Organic Compound Analysis by Method 8021B
8081A	GC.72	Pesticide Analysis by Method 8081A
8082	GC.73	PCB Analysis by Method 8082
8082/3580A	GC.26	Sample Preparation for PCB Oil Sample Analysis
8151A	GC.60	Analysis of Soil or Water Samples for Chlorinated Herbicides by Method 8151A
FL-PRO	GC.76	FL Petroleum Range Organics
OLM04.2; OLM04.3	GC.31	Pesticide/PCB by GC by Method OLM04.2, OLM04.3
TX1005	GC.78	TPH by TNRCC, Method TX 1005

ASC SOP INVENTORY

Method	SOP No.	SOP Name
RSK-175	GC.62	Gases by Headspace Analysis--Screening Method
	GC.74	Sample Preparation for PCB Wipe Sample Analysis
ASTM D1945	GC.88	Fixed Gases - Methane, Ethane, Ethene in Air
Gas Chromatography/Mass Spectrometry SOPs		
524.2	GCMS.08	EPA Method 524.2 for Volatile Analysis by Purge and Trap GC/MS
624	GCMS.11	Method 624 Volatile Analysis by Purge and Trap GCMS
625	GCMS.20	Semivolatile Analysis of Water Extracts by GC/MS Method 625
1624C	GCMS.38	GC/MS Analysis of Samples for VOCs by Method 1624C
1625	GCMS.39	Method 1625 Analysis of Semivolatile Organics by GC/MS Isotope Dilution
8260B	GCMS.17	GCMS Analysis of Samples for Volatile Organic Compounds by Method 8260B
8270C	GCMS.19	GCMS Analysis of Extracts for Semivolatile Organic Compounds by Method 8270C
OLM04.2	GCMS.24	CLP Volatile Analysis by Purge and Trap by Method OLM04.2
OLM04.2, OLM04.3	GCMS.23	CLP Analysis for Semivolatile Samples by Method OLM04.2, OLM04.3
OLM04.3	GCMS.46	CLP Volatile Analysis by Method OLM04.3
PAH_SIM_3520C_W; 3550B_S	GCMS.45	Semivolatile Analysis for PAH Compounds by Selective Ion Monitoring
TO-14	GCMS.29	Analysis of Volatile Organics in Air by GCMS
	GCMS.44	GC/MS Data Archive, Storage, and Security
TO-15	GCMS.47	Method TO-15 Analysis of Volatile Organics in Air Using GCMS
High Performance Liquid Chromatography (HPLC) SOPs		
8310/3550B/3510C/3520C	LC.7	Determination of PAH by HPLC
8330	LC.8	Determination of Nitroaromatics and Nitramines by HPLC Method 8330
8330 NGPETN Wipes	LC.27	Sample Preparation for Nitroaromatics, Nitroamines, and Nitroglycerin Wipe Samples Analysis
Organic Acids	LC.26	Organic Acids by 3510C
Metals SOPs		
200.3	Metals.82	Sample Preparation of Biological Tissues for ICP and ICP-MS
200.13	Metals.83	Extraction and Concentration of Trace Metals in Seawater Using Empore Chelating Disks
1311	Metals.08	Toxicity Characteristic Leaching Procedure
1312	Metals.76	Synthetic Precipitation Leaching Procedure
200.7, Rev.4.4	Metals.54	Digestion of Drinking Water Samples by Method 200.7, Rev. 4.4
200.7, Rev.4.4	Metals.78	Analysis of Drinking Water by Method 200.7, Rev.4.4
3005A	Metals.77	Method 3005A, SW-846 Total Recoverable Metals-Block Digestion
3010A	Metals.72	Digestion of Waters by Method 3010A Using Block Digestion for ICP Analysis
3020A	Metals.79	Digestion of Waters by 3020A Using Block Digestion for GFAA Analysis

ASC SOP INVENTORY

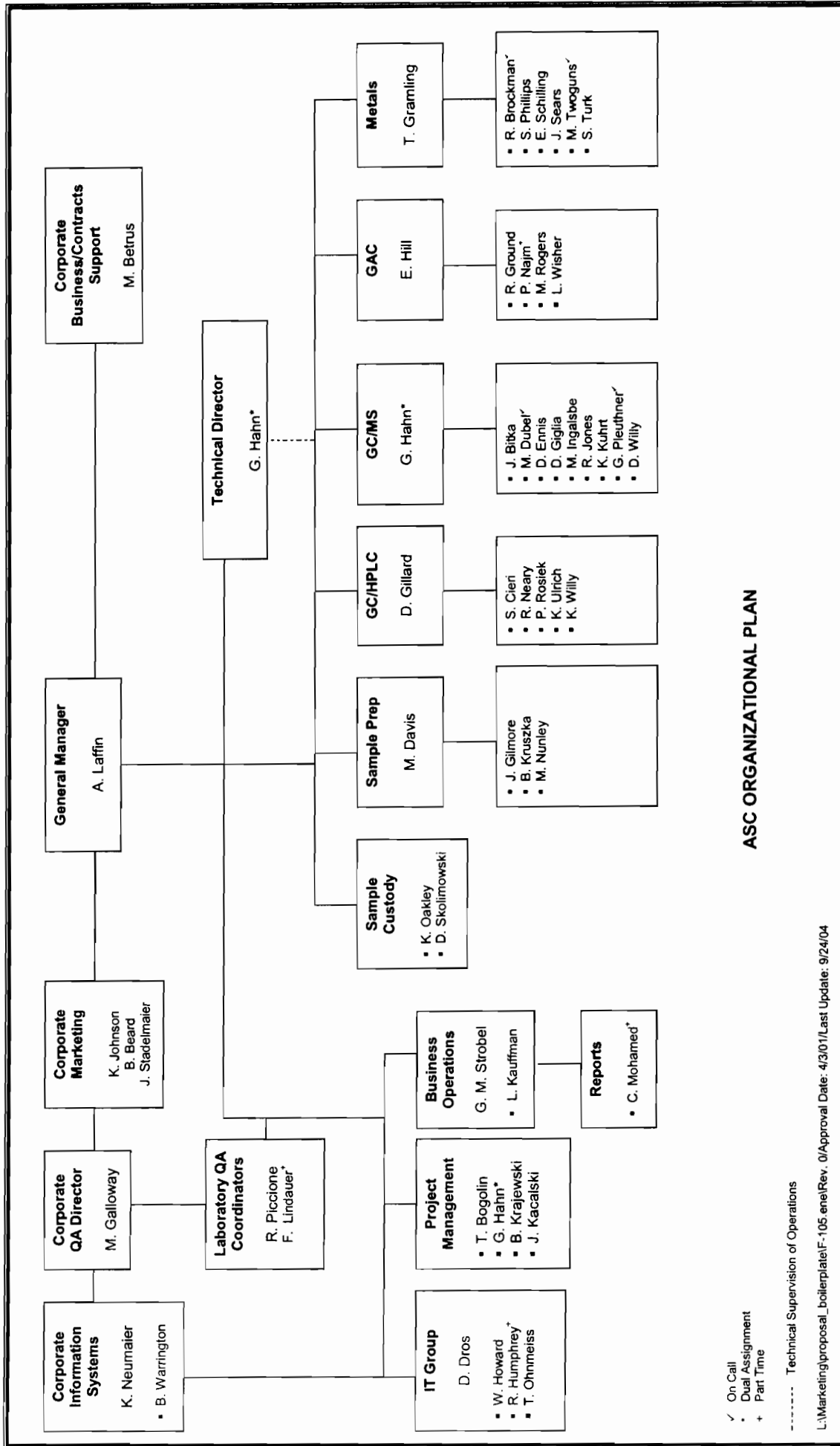
Method	SOP No.	SOP Name
3050B	Metals.73	Digestion of Soil Samples By Method 3050B - Block Digestion
40 CFR Part 136 Method 200.7	Metals.74	Total Digestion of Wastewater (SPDES) by 40 CFR Part 136 Method 200.7 - Block Digestion
40 CFR Part 136 Method 200.7	Metals.75	Total Recoverable Digestion of Wastewater (SPDES) by 40 CFR Part 136 Method 200.7 - Block Digestion
6010B	Metals.18	ICP Metals Analysis by Method 6010B
6020A	Metals.89	Metals by ICP-MS for Method 6020A
7470A	Metals.70	Preparation for Mercury in Water Samples by Method 7470A Using Block Digestor
7471A	Metals.71	Preparation for Mercury in Soil Samples by Method 7471A Using Block Digestor
7471A	Metals.84	Preparation for Mercury in Wipes Using Block Digestion
7470A, 7471A; ILM04.1, ILM05.2	Metals.67	Mercury Analysis
9081	Metals.68	Cation Exchange Capacity of Soils (Sodium Acetate) by Method 9081
CA WET	Metals.15	California WET
ILM04.1, ILM05.2	Metals.21	Preparation for Mercury in Water Samples by CLP Protocol
ILM04.1, ILM05.2	Metals.36	GFAA and ICP Digestion of Solids by CLP Protocol
ILM04.1, ILM05.2	Metals.37	Digestion of Waters by CLP Protocol for ICP and ICPMS
ILM04.1, ILM05.2	Metals.60	Preparation for Mercury in Soil Samples by CLP Protocol
ILM04.1; ILM05.2	Metals.30	ICP Metals by CLP Protocol
ILM05.2	Metals.85	Metals by ICP-MS Following CLP
NIOSH 6009	Metals.66	Preparation for Mercury in Air from Solid Sorbent Tubes by NIOSH 6009--Block Digestion
NIOSH 7300,40 CFR 50 APPG	Metals.04	Digestion Procedure for Cassette Air Filters or High Volume Air Filter
	Metals.59	Interelement Correction Factor Determination
ILM05.2	Metals.86	Preparation for Mercury in Soil Samples by ILM05.2
	Metals.69	Preparation for Mercury in Wipes
Quality Assurance SOPs		
	QA.01	Corrective Action Process
	QA.05	Training Program
	QA.18	Standard Operating Procedures, Use and Administration
	QA.19	Internal Audits
	QA.20	Control Charting
Reports SOPs		
	Rep.06	CLP Data Deliverables for Organics Analysis
	Rep.07	CLP Data Deliverables for Inorganics Analysis
	Rep.08	Job Case Filing
	Rep.12	Data Entry and Changes to CLP Data and Deliverables

ASC SOP INVENTORY

Method	SOP No.	SOP Name
	Rep.20	Standard Data Package Deliverables
	Rep.21	Delivery of Laboratory Reports
Sample Management SOPs		
	SM.01	Sample Receipt
	SM.02	Sample Log In
	SM.04	Sample Custody Procedure
	SM.10	Sample Splitting
	SM.11	Completion of USEPA CLP Sample Log-in (Form DC-1)
	SM.12	New Jersey Chain of Custody Procedures
	SM.13	Radiation Monitoring of Coolers and Samples

G

Organization Chart with Current Staffing



ASC ORGANIZATIONAL PLAN

✓ On Call
• Dual Assignment
+ Part Time

----- Technical Supervision of Operations

Appendix B – Health & Safety Plan Addendum
COMMUNITY AIR MONITORING PLAN
NYSEG
FORMER MGP
AUBURN, NEW YORK

Real-time air monitoring for volatile organic compounds will be conducted at the perimeter of the Exclusion Zone during the drilling program as follows:

- Volatile organic compounds and dust particulates will be monitored at the downwind perimeter of the exclusion zone on a continuous basis. If total organic vapor levels exceed 5 parts per million (ppm) above background, work activities will be halted and monitoring continued under the provisions of a Vapor Emission Response Plan. All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review if requested.
- If particulate levels at the downwind station exceed particulate levels at the upwind station by more than 100 micrograms per cubic meter (mcg/m^3), work activities will be halted and appropriate dust suppression measures will be employed. All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review if requested

Vapor Emission Response Plan

If the ambient air concentration of total organic vapors at the downwind perimeter of the Work Area or Exclusion Zone exceed 5 ppm above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the Exclusion Zone, activities can resume provided the organic vapor level 200 feet downwind of the Exclusion Zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 10 ppm at the perimeter of the Exclusion Zone, activities must be shut down. When work shutdown occurs, downwind air monitoring as directed by the Site HSO will be implemented to ensure that vapor emission does not impact the nearest residential or

commercial structure at levels exceeding those specified in the Major Vapor Emission Response Plan.

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

Major Vapor Emission Response Plan

If any organic vapor levels greater than 5 ppm over background are identified 200 feet downwind from the Exclusion Zone or half the distance to the nearest residential or commercial property, whichever is less, all work activities will be halted.

If, following the cessation of work activities, or as the result of an emergency, organic vapor levels persist above 5 ppm above background 200 feet downwind from the Exclusion Zone or half the distance to the nearest residential or commercial property, then the air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20-foot zone).

If efforts to abate the emission source are unsuccessful and organic vapor levels approaching 5 ppm persist for more than 30 minutes in the 20-foot zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect. Also, the Major Vapor Emission Response Plan shall be immediately placed into effect if 20-foot zone organic vapor levels are greater than 10 ppm above background.

Upon activation of the Major Vapor Emission Response Plan, the following activities will be undertaken:

- All Emergency Response authorities will immediately be contacted by the Site HSO and advised of the situation.
- Air monitoring will be conducted at 30 minute intervals within the 20-foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site HSO.

Particulate Monitoring, Response Levels and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate exceedances of the action level. In addition, fugitive dust migration will be visually assessed during all work activities.

If the downwind PM-10 particulate is 100 mcg/m^3 greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the up wind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the up wind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 above the upwind level and preventing visible dust migration.

All readings will be recorded and available for NYSDEC and NYSDOH personnel to review.

**HEALTH AND SAFETY PLAN (HASP)
NYSEG
FORMER MANUFACTURED GAS PLANT (MGP)
AUBURN, NEW YORK**

Job No.: 11173291.00000
Prepared by: Thomas M. Shine
Date: November 24, 2003

NYSEG-Auburn, NY
L7103HASP.doc

**HEALTH AND SAFETY PLAN
NYSEG
FORMER MANUFACTURED GAS PLANT
AUBURN, NEW YORK**

PHONE/CELL

Project Number:	11173291.00000	
Project Manager:	Mr. Jack Wilcox, P.E.	(716)-856-5636
Technical Manager	Mr. Michael Gutmann	(716)-856-5636
Site Manager:	Scott McCabe	(518) 688-0015
Site Safety Officer:	Eric Lovenduski	(518) 688-0015
Plan Preparer:	Mr. Thomas Shine	(518) 688-0015/(518)-791-3733
Preparation Date:	November 24, 2003	
Expiration Date:	November 21, 2005	

APPROVALS

Health and Safety Representative:

Eric Lovenduski for Tom Shine 10/13/04
(DATE)

Regional Health and Safety Manager:

[Signature] *13 Oct 04*
CIH/CSP (DATE)

Project Manager:

[Signature] *Oct. 13, 2004*
(DATE)

This Health and Safety Plan is valid only for this specific project as described in Section 3.0. It is not to be used for other projects or subsequent phases of this project without the written approval of the Regional Health and Safety Manager. A copy of this plan is to be maintained at the site at all times.

**HEALTH AND SAFETY PLAN
NYSEG
FORMER MANUFACTURED GAS PLANT
AUBURN, NEW YORK**

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ATTACHMENTS

ATTACHMENT A	HOSPITAL ROUTE MAP
ATTACHMENT B	SAFETY PLAN COMPLIANCE AGREEMENT AND MEDICAL EMERGENCY CONTACT SHEET
ATTACHMENT C	SAFETY MANAGEMENT STANDARDS
ATTACHMENT D	FORMS
ATTACHMENT E	MATERIAL SAFETY DATA SHEETS

Addendum Community Air Monitoring Plan

GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
analyzer	refers to the field instrument described in Section 6.1
atm	atmosphere
EC	centigrade
Carcinogen	a substance that can cause cancer
cc	cubic centimeter
CGI	Combustible Gas Indicator
CNS	Central Nervous System
eV	Electron Volts
EF	Fahrenheit
HSP	Health and Safety Plan
kg	kilogram
LEL	Lower Explosive Limit
Lpm	liters per minute
MSDS	Material Safety Data Sheet
m	meter
mg	milligram
mg/M ³	milligrams per cubic meter
ml	milliliter
mm	millimeter
ND	not detected
NIOSH	National Institute for Occupational Safety and Health
OBZ	operator's breathing zone
OEL	occupational exposure limit
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	project manager
ppb	parts per billion
ppm	parts per million
REL	Recommended Exposure Limit
RHSM	Regional Health and Safety Manager
SMS	Safety Management Standard
SSO	Site Safety Officer
SSR	Subcontractor's Safety Representative
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
UEL	Upper Explosive Limit
URS	URS Corporation and Subsidiaries
VOC	Volatile Organic Compound

**HEALTH AND SAFETY PLAN
NYSEG
FORMER MANUFACTURED GAS PLANT
AUBURN, NEW YORK**

**1.0 PLAN-AT-A-GLANCE
HSP SUMMARY SHEET**

THIS SUMMARY SHEET IS PROVIDED AS A QUICK-REFERENCE/OVERVIEW ONLY. THE REMAINDER OF THIS SITE-SPECIFIC HSP IS INTEGRAL TO THE SAFE CONDUCT OF SITE OPERATIONS AND MUST BE APPLIED IN ITS ENTIRETY.

EMERGENCY INFORMATION

Ambulance - 911
Fire - 911
Police - 911
Hospital - 1-315-255-7011

Project Manager:	Jack Wilcox	(716)856-5636
Health and Safety Representative:	Thomas Shine	(518) 688-0015
Regional Health and Safety Manager:	Steven J. Sherman	(716)856-5636 (215) 542-3800

Alternates

National Response Center (800) 424-8802

HOSPITAL DIRECTIONS:

Auburn Memorial Hospital
17 Lansing St. #1
Auburn, New York
(315) 255-7011

To reach the hospital from the site, head east on to Clark Road, take a right onto North Division Street. Take a left onto Rt. 5/20. At Rt. 34 take a left. Follow Rt.34 to Lansing Street. Take right on to Lansing Street. Auburn Memorial Hospital is located on the left. Approximate trip distance is 1.1 miles.

Additional information concerning emergency procedures is located in Section 12.0 and the hospital route map is located in Attachment A. A copy of the hospital route map must be readily available in each site vehicle that may be used to transport accident victims to the hospital.

CONSTITUENTS OF CONCERN

1. Coal Tar – BTEX and PAHs
2. Cyanides
3. Heavy Metals

Additional information regarding site history, constituents of concern, and scope of work activities is located in sections 2.0 and 5.0.

PROJECT HAZARD ANALYSIS

Task	Chem. Hzds.	Heat/Cold Stress	Noise	Slip/Trip/Fall	Lifting Hzds.	Mech'l. Hzds.	Electro-cution	Explosion	Excav-ation
1. Soil Borings and soil sampling	med	med	med	med	low	med	n/a	n/a	n/a
2. Monitoring Well Installation	med	med	med	low	low	low	n/a	n/a	n/a
3. Groundwater Sampling	low	med	n/a	low	low	low	n/a	n/a	n/a
4. Test Trenches	low	med	med	med	low	med	n/a	n/a	med
5. Surface Water and Sediment Sampling.	med	med	n/a	low	med	low	n/a	n/a	n/a

High - Exposure likely more than 50% of the time

Low - Exposure likely less than 10% of the time

Med - Exposure likely 10-50% of the time

n/a – Exposure not anticipated

Additional information concerning Project Hazards and their control can be found in Section 5.0.

TASK	MINIMUM PROTECTIVE CLOTHING/EQUIPMENT REQUIREMENTS
1	Steel-toed boots, hard hat, safety glasses, hearing protection, work gloves, Tyvek [†] , nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.
2	Steel-toed boots, hard hat, safety glasses, hearing protection, work gloves, poly-coated Tyvek, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.
3	Steel-toed boots, hard hat, safety glasses, poly-coated Tyvek, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.
4	Steel-toed boots, hard hat, safety glasses, work gloves, poly-coated Tyvek, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.
5	Steel-toed boots or waders, hard hat, safety glasses, life jackets, poly-coated Tyvek, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.

PROTECTIVE CLOTHING (First Action Level)

Chemical Protective Clothing

Outer Coveralls: Kleenguard[®] or Tyvek[®]†

Outer Gloves: Nitrile

Inner Gloves: Surgical Nitriles

Chemical protective steel-toed boots or chemical-resistant boot covers over steel-toed boots

‡ Substitute poly-Coated or Saran-coated Tyvek® if there is a potential for contact with liquids (groundwater, mud, etc.)

Each person should wash daily at the end of each work shift. Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the job site.

The HASP Preparer has conducted a Hazard Assessment for this project based upon information provided by the Project Manager, in accordance with 29 CFR 1910.132(d).

For more information on PPE and respiratory protection requirements, see the Action Levels table (Page 6) and Section 7.0.

ENGINEERING CONTROLS TO BE USED (as applicable)

- Water spray for dust suppression
- Natural wind forces to reduce exposure to airborne contaminants (i.e., work upwind)
- Forced air ventilation (fans) to reduce potential airborne exposures
- Light colored PPE to reduce solar load for heat stress control
- Dining canopy to provide shaded work/rest area for heat stress control

For more information, see Section 5.0

INSTRUMENTATION TO BE USED

☐ HNu PID w/ eV probe
☒ OVM PID w/ 10.6 eV lamp
☐ Photovac Microtip PID w/ ☐ eV lamp
☐ MiniRAE PID w/ ☐ eV lamp
☒ Combustible Gas/O₂ Indicator
☐ Foxboro OVA (FID)
☒ Miniram Real-time Dust Monitor
☒ Other ☐ Monitox or equivalent cyanide monitor _____

For more information, see Section 6.0

PERSONAL EXPOSURE SAMPLING

☐ Will be conducted
☒ Will be conducted if PID readings require the use of respiratory protection as described in the Action Level Table (page 6) and in Section 6.1.1
☐ Is not anticipated

For more information on Monitoring, see Section 6.0

HAZ-COM MATERIALS INVENTORY

- TSP or Alconox (decontamination)
- Isobutylene - 10ppm (calibration gas)
- Sulfuric Acid (sample preservative)
- Hydrochloric Acid (sample preservative)
- Citrusolve™ (decontamination)
- Nitric Acid (sample preservative)
- Simple Green™ (decontamination)

ACTION LEVELS (for Photoionization Detector)

Analyzer Reading*	Location	Duration	Action	Personal Protective Equipment
5-<15 ppm (1 st Action Level)	OBZ	> 1 minute	Monitor OBZ; don protective clothing; establish work zones as described in Section 8.1	Minimum Site Ensemble
15-50 ppm (2 nd Action Level)	OBZ	> 1 minute	Monitor OBZ, provide respiratory protection.	Add full-face respirators with organic vapor /P100cartridges
>50 ppm (3 rd Action Level)	OBZ	>1 minute	Stop work; move upwind while vapors dissipate. If elevated levels remain, cover boring and cuttings, evacuate upwind and notify RHSM or PM.	As specified by RHSM

*above background readings

OBZ= Operator's Breathing Zone

RHSM = Regional Health and Safety Manager

‡Substitute poly-coated or Saranex Tyvek® if there is potential for contact with liquids (groundwater, mud, etc)

ACTION LEVELS (for the Combustible Gas Indicator)

LEL Reading	Location	Action
<10% LEL	Point of Operations/General Work Area	Continue site operations and continue periodic monitoring
10-20% LEL	Point of Operations/General Work Area	Continue site operations and perform continuous monitoring
>20% LEL	Point of Operations/General Work Area	Shutdown operations, evaluate source, ventilate work area

LEL = Lower Explosive Limit

For additional information on Action Levels and their implementation, see Sections 6.0 and 7.0

HEALTH AND SAFETY EQUIPMENT LIST

Required	As Necessary	
X		URS Safety Management Standards (relevant to project - see next page)
X		OSHA "Safety on the Job" Posters
X		Hardhats
X		Safety glasses
X		Ear plugs or muffs
	X	Cotton coveralls
	X	Traffic safety vest
X		Tyvek® coveralls
	X	Polycoated Tyvek® Q-23 Coveralls
X		Steel-toed boots
X		Chemical-resistant steel-toed boots or chemical-resistant boot covers
	X	Work gloves
X		Nitrile outer gloves
X		Surgical nitrile inner gloves
X		Plastic sheeting (visqueen)
	X	55 gallon 17-H drums (for contaminated solids)
	X	55 gallon 17-E drums (for liquids)
	X	Drum liners
	X	Barricade tape and barricades
	X	Wash tubs and scrub brushes
X		Decon solution (i.e., TSP)
	X	Folding chairs
	X	5 or 10 gallon portable eyewash
	X	Respirator sanitizing equipment
X		First Aid kit
X		Infection control kit
X		Drinking water
X		Gatorade or similar drink
X		Type ABC fire extinguishers
		Half-face respirators (NIOSH approved)
	X	Full-face respirators (NIOSH approved)
X		Respirator cartridges [organic/P100 combo]
X		Photoionization Detector (PID) w/[10.6] lamp and calibration kit
	X	Combustible Gas Indicator and calibration kit
	X	Garden sprayer
	X	Compressed gas horn
X		Duct tape
X		Paper towels and hand soap
	X	Spill sorbent
X		Plastic garbage bags
	X	Broom and/or shovel

SAFETY MANAGEMENT STANDARDS REFERENCED BY THIS HSP

SMS	TOPIC	HSP SECTION
2	Worker Right to Know	5.1.2
9	Corrosive Materials (Sample Preservation)	1.0
12 / 15	Electrical Equipment	5.2
13	Excavation Safety	5.2.9
14	Fire Prevention	12.2
16	Hand Tools	5.2
17	Hazardous Waste Site Investigation	5.1
18/59	Heat/Cold Stress	5.2.1 / 7.2
19	Heavy Equipment Operations	5.2.6
26	Noise and Hearing Conservation	5.2.3
27	Water Safety	5.2 / 5.2.11
29	Personal Protective Equipment	7.0
30	Sanitation	10.1
32	Traffic Control	5.2.8
34	Utility Clearances	5.2.7
42	Respiratory Protection	8.3/8.9
43	I.H. Monitoring	6.1.1
45	Back Injury Prevention	5.2.5
46	Subcontractors	4.0
47	Biological Hazards	5.2.11 / 5.3.2
49	Incident Reporting	5.2 / 12.6
51	Blood-borne Pathogens	5.3.1
56	Drilling	5.2

Copies of Safety Management Standards are available on the URS Safety Intranet at healthandsafety/http://www.oklink.com/safety/. Use the "Print This SMS" function on the "Safety Management Standards" page to print the complete SMS.

Copies of the SMSs referenced by this HSP are to be maintained on site. Project Managers are responsible to see that other SMSs relevant to field activities but not directly referenced by this HSP are also available on site.

2.0 FACILITY BACKGROUND/WORK PLAN

2.1 SITE DESCRIPTION

The site is in Auburn, Cayuga County, in the Finger Lakes Region of New York State. The location of the site is shown in Figure 1. The site is approximately three acres in size and is currently occupied by a NYSEG substation transformer area and a gas regulation building. A fence surrounds the substation transformer area. The majority of the site is covered with gravel, with surrounding areas covered by trees and grassy areas. Land in the vicinity of the site is mixed commercial and residential. A vehicle maintenance shop to the southwest, an access road and Conrail right-of-way to the south, and the Owasco Outlet to the north and east border the site. The locations of the present and former structures are shown on Figure 2.

2.2 SITE HISTORY

MGP operations at the Clark Street site began in approximately 1901. The gas house was at the southern edge of the property and consisted of an engine room, purifier room, meter room, generator room, and boiler room containing two boilers for steam production. Two gas holders were present north of the gas house, GH#2 (204,000 cubic feet) and GH#3 (75,000 cubic feet). An oil tank was west of the gas house, and a shed was north of the gas holders.

Citizen's Light, Heat & Power Company owned the site from 1901 to 1905. Auburn Gas Company owned the site from 1905 to 1911, and Empire Gas & Electric Company owned the site from 1911 to 1936. According to a 1926 Sanborn map included in BBL's 1994 *Task II RI Report*, GH#2 and GH#3 were still present, and a third gas holder, GH#1 (210,000 cubic feet) replaced the oil tank west of the gas house. A third boiler was added to the gas house in 1943, and a coal storage area and a tar shed (later referred to as a tar pumping house) were added on the north side of the gas house. NYSEG obtained ownership of the site in 1936. GH#2, GH#3 and the remaining oil tank were removed in 1939. GH#1 was increased to 491,000 cubic feet in 1943. Gas production continued until 1946, when portions of the gas house were converted to a carpenter shop, storage area, regulator room, fireproof regulator room, and booster room. By 1958, GH#1 was removed, the substation transformer area was built, the boiler room of the gas house was being used as a welding room, and a new boiler room was built on the north side of the building. The gas house was demolished in 1961, with the exception of the gas regulator building.

Historical plant operations were described in BBL's 1994 *Task II RI Report*. Coal was transported to the site via the railroad adjacent the site to the south. Coke ovens were used to generate coke from the coal. The byproduct gases may have been collected and reused as a fuel source for heating the coke ovens. The coke/coal was heated in the generator room and used as a fuel source for the boilers, which in turn produced steam. The steam was then introduced into the boilers to create blue gas. The blue gas was introduced into the carburetor/superheater (in the generator room) and sprayed with oil. Thermal cracking of the oil into gas produced gaseous hydrocarbons and tars. The carbureted water gas was then metered in the meter room and stored

in the gas holders. The manufactured gas may have been stored in one of the gas holders (a relief holder) prior to purification to equalize pressure during the gas production process. GH#2 and GH#3 were water seal holders, which may have stored tars/water emulsions. GH#1 could have been a waterless holder. Prior to distribution, gases stored in these holders were metered through the meter room.

A NYSEG substation transformer area and a gas regulation building currently occupy the site. The foundation of the former gas house and former GH#1 are visible, as well as portions of the former coke ovens southwest of the gas house.

2.3 PURPOSE AND SCOPE OF WORK

The field activities presented in the *SRI Work Plan* are briefly discussed below.

TASK 1 - INSTALL SOIL BORINGS AND SAMPLE SOILS

URS will advance 21 soil borings using both GeoProbeTM or equivalent direct push equipped rig. Each of the purposed soil borings will be advanced to the bedrock surface at a depth of approximately 12 to 15 feet below ground surface (bgs). Soil sample selection will be based upon visual observations and with the use of a photoionization detector (PID) or equivalent. At the completion of each soil boring, the boring will be backfilled to the surface with cement-bentonite grout or bentonite pellets. All soil generated during the advancement of the borings will be containerized and stage onsite for later disposal. Three surface soil samples will also be collected as part of this task.

TASK 2 – MONITORING WELL INSTALLATION

Overburden and shallow bedrock monitoring wells will be drilled by advancing hollow-stem augers through the overburden until bedrock is encountered. Continuous split-spoons will be collected in the overburden, described by a geologist and field screened for the presence of NAPLs and VOCs.

The overburden casing will be installed five feet into the bedrock. Following, bedrock will be continuously cored using a NX (2.150-inch nominal diameter) core bit to the desired total depth. Based on observations from the bedrock core, the well will either remain open hole, or the boring will be reamed out to allow for construction of a two-inch diameter monitoring well.

Upon completion, all new wells will be developed using surging and pumping methods to remove fine-grained sediments from the sand pack and to improve the hydraulic communication between the well screen and the surrounding aquifer. Development water will be containerized in drums or a temporary storage tank for future off-site disposal.

TASK 3 – GROUNDWATER SAMPLING

Groundwater samples will be collected from each of the existing and new monitoring wells installed. A submersible pump will be used to purge the monitoring wells. Field parameters will

be recorded during the purging process. Once the field parameters have stabilized, water samples will be collected directly from the pump effluent. The purge water generated will be containerized and staged at an on-site location for future off-site disposal.

TASK 4 – TEST TRENCHES

Seven trenches will be excavated inside the perimeter of the site. The purpose of the trenches is to visually inspect the water table for evidence of contamination and to further characterize the soils. The trenches will be excavated to approximately 20 feet long and extend to just below the water table at a depth of approximately 4 feet bgs.

TASK 5 – SURFACE WATER AND SEDIMENT SAMPLING

URS will complete a sediment probing program in the Owasco Outlet to obtain data regarding sediment thickness, vertical profiles with the respect to sediment composition and the olfactory or visual evidence of impacts, if any, at transects upstream, adjacent to, and downstream of the former MGP site. These transects will be at 100 foot intervals beginning 500 feet upstream and extending to 500 downstream of the site.

3.0 APPLICABILITY

The purpose of this plan, which was developed specifically for operations at the **NYSEG Former Manufactured Gas Plant site, in Auburn, New York** is to assign responsibilities, establish personal protection standards and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the site. This plan complies with, but does not replace, Federal Health and Safety Regulations as set forth in 29 CFR 1910 and 1926, and applicable state regulations. This plan is to be used by URS personnel as a supplement to such rules, regulations, and guidance. This health and safety plan is to be augmented by the URS Health and Safety Program and Management System, relevant standards from which are required to be available on site during all activities.

The provisions of the plan are mandatory for all onsite URS employees engaged in hazardous material management activities associated with this project, which may involve health and safety hazards.

Changing and/or unanticipated site conditions may require modification of this site safety plan in order to maintain a safe and healthful work environment. Any proposed changes to this plan should be reviewed with an URS Health and Safety Professional prior to their implementation. If this is not feasible, the site/project manager may modify the plan and record all changes in the field logbook; under no circumstances will modifications to this plan conflict with Federal, state, or other governmental health and safety regulations.

URS is providing a copy of this Health and Safety Plan to each site subcontractor in order to fulfill its obligation under 29 CFR 1910.120(b) to inform subcontractors of site hazards. Each subcontractor is to provide a health and safety plan that complies with 29 CFR 1910.120 and addresses the activities of its employees relative to this project.

4.0 RESPONSIBILITIES

URS will have site safety and health oversight and coordination responsibilities for URS personnel; each subcontractor will be held accountable for the safe and healthful performance of work by each of their employees, subcontractors, or support personnel who may enter the site. URS will strictly adhere to the provisions of this health and safety plan, along with the applicable regulations issued by governmental entities.

4.1 PROJECT MANAGER (URS)

The Project Manager (PM) shall direct URS onsite operations. The PM may delegate all or part of these duties to a properly qualified URS employee who is designated as the Site Manager. At the site, the PM, assisted by the Site Safety Officer (SSO), has primary responsibility for:

1. Seeing that appropriate personal protective equipment and monitoring equipment is available and properly utilized by all onsite URS employees.
2. Establishing that URS personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies.
3. Establishing that all URS onsite personnel have completed a minimum of 40 hours of health and safety training and have appropriate medical clearance as required by 29 CFR 1910.120, and have been fit tested for the appropriate respirators.
4. Seeing that URS personnel are aware of the potential hazards associated with site operations.
5. Monitoring the safety performance of all URS personnel to see that the required work practices are employed.
6. Correcting any URS work practices or conditions that may result in injury or exposure to hazardous substances.
7. Preparing any accident/incident reports for URS activities (see Section 12.6).
8. Seeing to the completion of Plan Compliance Agreements by URS personnel (See Attachment B).
9. Halting URS site operations, if necessary, in the event of an emergency or to correct unsafe work practices.
10. Seeing that utility clearances are obtained prior to the commencement of work (see Section 5.2.7).

11. Seeing that the appropriate Safety Management Standards are appended to this HSP and are available on site (see "Plan at a Glance").
12. Reviewing and approving this project health and safety plan.

4.2 SITE SAFETY OFFICER (URS)

The Site Safety Officer's (SSO) duties may be carried out by the PM or other qualified URS site manager. The SSO is responsible for:

1. Implementing project Health and Safety Plans, and reporting any deviations from the anticipated conditions described in the plan to the PM, and, if necessary, the RHSM.
2. Determining that monitoring equipment is used properly by URS personnel and is calibrated in accordance with manufacturer's instructions or other standards, and that results are properly recorded and filed.
3. Check with Health and Safety Representative to assure URS personnel have current medical clearance and training.
4. Assuming any other duties as directed by the PM or RHSM.
5. Coordinating with URS Health and Safety Professional to identify URS personnel on site for whom special PPE, exposure monitoring, or work restrictions may be required.
6. Conducting safety meetings for all site personnel in accordance with Section 13.
7. Conducting daily site inspections prior to the start of each shift. All inspections must be documented (preferably in a bound field logbook).
8. Providing ongoing review of the protection level needs as project work is performed, and informing the PM of the need to upgrade/downgrade protection levels as appropriate.
9. **Contacting the RHSM to perform personal industrial hygiene monitoring for aromatic hydrocarbons if the second action level is reached as described in the Action Level Table (page 6) and Section 6.1.1.**
10. Seeing that decontamination procedures described in Section 10.0 are followed by URS personnel.
11. Establishing monitoring of URS personnel and recording results of exposure evaluations.

12. Halting URS site operations, if necessary, in the event of an emergency or to correct unsafe work practices.
13. Maintaining the visitor log.
14. Posting OSHA "Safety of the Job" and other required posters at the site.

4.3 REGIONAL HEALTH AND SAFETY MANAGER (URS)

The Regional Health and Safety Manager (RHSM) is responsible for:

1. Determining the need for periodic audits of the operation to evaluate compliance with this plan.
2. Providing health and safety support as requested by the SSO and PM.

4.4 PROJECT PERSONNEL (URS)

Project personnel involved in onsite investigations and operations are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees.
2. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the SSO or PM.
3. Implementing the procedures set forth in the Health and Safety Plan, and reporting any deviations from the procedures described in the Plan to the SSO or PM for action.
4. Notifying the PM and SSO of any special medical problems (i.e., allergies) and seeing that all onsite URS personnel are aware of such problems.
5. Reviewing project health and safety plan and signing Safety Plan Compliance Agreement.

4.5 SUBCONTRACTOR'S SAFETY REPRESENTATIVE

Each subcontractor is requested to designate a Subcontractor's Safety Representative (SSR) who is the subcontractor supervisor. The SSR is responsible for the safe and healthful performance of work by his work force and subcontractors. During subcontractor activities onsite, the SSR will perform continuing work area inspections, and conduct safety meetings and safety orientations for all new employees. The SSR will attend periodic safety meetings with the SSO. The SSR will also investigate accidents and overexposures involving subcontractor personnel.

5.0 JOB HAZARD ANALYSIS

5.1 CHEMICAL HAZARDS

There are two categories of chemical hazards associated with site activities:

- Site Constituents
- Chemicals used to conduct the site work

Site constituents are those which exist at the site and are the cause for conducting site activities. The chemicals that are brought on site in order to conduct the work may be hazardous and subject to regulation under OSHA's Hazard Communication Standard (29 CFR 1910.1200).

5.1.1 Site Constituents

From an occupational health standpoint, given that any potential exposure to site personnel will be only for a ***short period of time (intermittent for several days)***, the levels of contaminants that have been, or could be, encountered during site activities ***should not represent a significant concern*** if the provisions of this HSP are appropriately implemented. However, ***the site is still under investigation***, so the potential for exposure to elevated levels of these contaminants may exist. Overviews of the hazards associated with exposure to elevated levels of these contaminants may exist. Overviews of the hazards associated with exposure to the chemicals that may pose a hazard during site activities are presented below in terms of the following types of occupational exposure limits:

PEL - Permissible Exposure Limit (OSHA Standard)
TLV - Threshold Limit Value (ACGIH Guidance)
REL - Recommended Exposure Limit (NIOSH Guidance)
STEL- Short Term Exposure Limit
C - Ceiling

OSHA Permissible Exposure Limits (PELs), ACGIH Threshold Limit Values (TLVs), and NIOSH Recommended Exposure Limits (RELs) are time-weighted averages (TWAs) defined as concentrations for a normal 8-hour work day and 40-hour work week to which almost all workers can be repeatedly exposed without suffering adverse health effects

Short Term Exposure Limit (STEL) is defined as the concentration to which workers can be exposed for short time periods without irritation, tissue damage, or narcosis sufficient to likely cause impairment of self-rescue or precipitate accidental injury. The STEL is a 15-minute time-weighted average that should not be exceeded at any time during the workday. OSHA, ACGIH and NIOSH use STELs for chemical exposure criteria.

A ceiling value (C) is a concentration that should not be exceeded at any time in any workday. OSHA, ACGIH and NIOSH use ceiling limits for chemical exposure criteria. A skin notation indicates significant exposure potential exists through dermal absorption.

Summaries on the site constituents of concern are in Table 1.

TABLE 1

Chemical Name	OSHA PEL	Routes of Exposure	Health Hazards/Target Organs	Symptoms of Overexposure
Coal Tar	0.2 mg/m3	Inhalation, skin and/or eye contact	Skin, Respiratory System, Bladder, Kidneys[carcinogen]	Dermatitis, Bronchitis
Benzene	0.5 ppm {skin notation]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eye & Central Nervous System Depressant [carcinogen]	Irritation of Eyes , Headache, Nausea, Tremors & Fatigue
Ethyl Benzene	100 ppm	Inhalation, ingestion, skin and/or eye contact	Eye, Mucous Membrane & Skin Irritant	Irritation of Eyes, Headache, and Dermatitis
Naphthalene	10 ppm [skin notation]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eyes, skin, blood, liver, kidneys, Central Nervous System	Irritation of Eyes, headache, confusion, profuse sweating
Toluene	100 ppm [skin notation]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eye & Central Nervous System Depressant	Irritation of Eyes, Headache, Nausea, Dizziness & Fatigue
Xylenes	100 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eye, Nose, Throat and Skin Irritant, Central Nervous System Depressant	Headache, Nausea, & Fatigue
Cyanides (inorganic)	5 mg/m3 (solid) (10 ppm air) [skin notation]	Inhalation, skin, ingestion [dermal exposure hazard]	Eyes, skin, respiratory system, central nervous system, blood, thyroid, cardiovascular system	Irritation or burning of eyes and skin, cough, sneezing, vomiting, or diarrhea

Skin contact with potentially contaminated materials will be minimized by the use of personal protective clothing (as described in Sections 1.0 and 7.0). Each person should wash daily at the end of each work shift. Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the job site.

Air monitoring and the use of engineering controls will minimize inhalation of vapors or particulates during the site activities, and respiratory protection will be used if Action Levels described in Section 1.0 are exceeded. Ingestion of contaminated materials will be minimized by the use of appropriate personal hygiene procedures during decontamination (i.e., thoroughly washing face and hands with soap and water after leaving the work area and prior to eating or drinking).

5.1.2 Hazard Communication Materials

Materials which are considered hazardous materials under the OSHA Hazard Communication Standard (29 CFR 1910.1200) may be used during this project. In accordance with the URS Hazard Communication Program, the MSDSs for the hazardous materials listed in Section 1.0 are included in Attachment E. The SSO will make copies of these MSDSs available to any subcontractors (i.e. drillers, excavators) on this project.

URS written Hazard Communication program is located in Safety Management Standard 2, a copy of which shall be maintained on site.

5.2 PHYSICAL HAZARDS

Physical hazards at this work site include:

- Heat stress and cold stress (SMS-18 and 59);
- Noise from the operation of site equipment (SMS-26);
- Slip-trip-fall type of accidents (SMS-49);
- Back injuries due to improper lifting (SMS-45);
- Being caught in or struck by moving equipment (SMS-19);
- Drilling activities (SMS-34 and 56);
- Electrocution or explosion hazards associated with drilling or excavation activities such as contact with overhead or underground power lines or pipelines (SMS-12 and 15);
- Excavation hazards (SMS-13 and 34);
- Sampling near water bodies (SMS-27).

5.2.1 Heat Stress Recognition and Control

Heat stress monitoring shall commence when personnel are wearing PPE, including Tyvek®-type coveralls, and the ambient temperature exceeds 70°F. If standard work garments (cotton coveralls) are worn, monitoring shall commence at 85°F. Additional information regarding Heat Stress is located Safety Management Standard 18, a copy of which shall be maintained on site.

5.2.2 Cold Stress Recognition and Control

Protection against cold stress should be initiated when temperatures drop below 45°F. Cold stress guidance is provided below.

Exposure to cold working conditions can result in cold stress (hypothermia) and/or injury (frostbite) to hands, feet, and head. Hypothermia can result when the core body temperature drops below 36°C (96.8°F). Lower body temperature will likely result in dizziness, drowsiness, disorientation, slurred speech, or loss of consciousness, with

possible fatal consequences. Pain the extremities may be the first warning of danger to cold stress. Shivering develops when the body temperature has fallen to 35°C (95°F). Hypothermia can be brought on by exposure to cold air, immersion in cold water, or a combination of both. Wind chill factor, the cooling power of moving air, is a critical factor in cold stress.

Workers must wear adequate insulating clothing if work is performed in temperatures below 4°C (40°F). At temperatures of 2°C (35.6°F or less), workers whose clothing becomes wet should be immediately provided with a change of clothing, and if necessary, treated for hypothermia. Treatment includes warming the victim with skin-to-skin contact, or by providing warm blankets or other coverings, and drinking warm liquids. Skin exposure should not be permitted at temperatures of -32°C (-25°F) or below.

If fine work is to be performed with bare hands for more than 10-20 minutes at temperatures below 16°C (60°F), provisions should be made for keeping the workers' hands warm. If equivalent chill temperatures fall below 40°F and fine manual dexterity is not required, then gloves should be worn. Metal handles of tools should be covered with insulating material at air temperatures below -1°C (30°F).

If work is to be performed continuously in the cold when the wind chill factor is at or below -7°C (19°F), heated warming shelters (tents, trailers, vehicle cabs) should be made available nearby.

5.2.3 Noise Hazards

Previous surveys indicate that heavy equipment such as **drilling or excavation** equipment may produce continuous and impact noise at or above the action level of 85 dBA. All URS personnel within 25 feet of operating equipment, or near an operation that creates noise levels high enough to impair conversation, shall wear hearing protective devices (either muffs or plugs). URS personnel who are in the Medical Surveillance program are automatically enrolled in the URS Hearing Conservation Program and have had baseline and, where appropriate, annual audiograms. Personnel will wash their hands with soap and water prior to inserting earplugs to avoid initiating ear infections. Additional information regarding the URS Hearing Conservation Program is located in Safety Management Standard 26, a copy of which shall be maintained on site.

5.2.4 Slip/Trip/Fall Hazards

Workers should exercise caution when walking around the site to avoid fall and trip hazards. If there are holes or uneven terrain in the work area that could cause site personnel to fall or trip, they must be covered, flagged or marked to warn workers. Workers should exercise caution around open excavations, such as test pits, and avoid getting closer than two feet to the edge of an unsloped excavation unless guardrails or fall protection is provided. If conditions become slippery, workers should take small steps with their feet pointed slightly outward to decrease the probability of slipping. Gravel or

sand should be spread in muddy areas to reduce slipperiness. Workers should watch where they are walking and walk only in areas of good stability.

5.2.5 Lifting Hazards

The following guidelines will be followed whenever lifting equipment such as portable generators, coolers filled with samples, any other objects that are of odd size or shape, or that weigh over 40 pounds. Safe lifting procedures are described in Safety Management Standard 45, a copy of which is to be available on site.

- Get help when lifting heavy loads. Portable generators will only be lifted using a two-person lift.
- When moving heavy objects such as drums or containers, use a dolly or other means of assistance.
- Plan the lift. If lifting a heavy object, plan the route and where to place the object. In addition, plan communication signals to be used (i.e., “1,2,3, lift,” etc.)
- Wear sturdy shoes in good conditions that supply traction when performing lifts.
- Keep your back straight and head aligned during the lift and use your legs to lift the load – do not twist or bend from the waist. Keep the load in front of you – do not lift or carry objects from the side.
- Keeping the heavy part of the load close to your body will help maintain your balance.

5.2.6 Heavy Equipment

Operation of heavy equipment during site activities presents potential physical hazards to personnel. Issues associated with heavy equipment operations are addressed in Safety Management Standard 19, a copy of which is to be maintained on site.

The following precautions must be observed whenever heavy equipment is in use:

- Personal protective equipment (PPE) such as steel-toed shoes, safety glasses or goggles, and hard hats must be worn whenever such equipment is present.
- Personnel must at all times be aware of the location and operation of heavy equipment, and take precautions to avoid getting the way of its operation. Never assume that the equipment operator sees you; make eye contact and use hand signals to inform the operator of your intent, particularly if you intend to work near or approach the equipment.

- Traffic safety vests **ARE REQUIRED** for URS personnel working near mobile heavy equipment, such as backhoes and other excavators.
- Never walk directly in back of or to the side of, heavy equipment without the operator's acknowledgment.
- When an equipment operator must operate in tight quarters, the equipment subcontractor should provide a person to assist in guiding the operator's movements.
- Keep all non-essential personnel out of the work area.
- Any heavy equipment that is used in the exclusion zone should remain in that zone until its task is completed. The equipment subcontractor should completely decontaminate such equipment in the designated equipment decontamination area as required prior to moving the equipment outside of the EZ/CRC.

5.2.7 Underground and Aboveground Utilities

The Site Manager or SSO is responsible locating that underground utilities prior to the commencement of any subsurface (> 0.3 meters (1 ft.) activities. Resources include site plans, utility companies, and regional utility locating services. The proper utility company personnel shall certify in writing to the Site Manager or SSO the deactivation of underground utilities, and the certification retained in the project files.

Procedures for activities proximal to utility locations are located in Safety Management Standard 34, a copy of which is to be maintained on site.

Excavation, drilling, crane, or similar operations adjacent to overhead lines shall not be initiated until operations are coordinated with the utility officials. Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:

- Power has been shut off and positive means (e.g. lockout/tagout, removal of meters, etc.) have been taken to prevent lines from being energized. Wherever possible, the URS SSO will observe power shut off and place a lock and tag on the switch. In all cases utility company personnel shall certify in writing to the Site Manager or SSO the deactivation of overhead utilities, and the certification retained in the project files. The Site Manager or SSO must also attempt to verify power shut off by checking that power is no longer available to the affected building or equipment.
- Equipment, or any part of the equipment, cannot come within the following minimum clearance from energized overhead lines:

<u>Power Lines Nominal System (kv)</u>	<u>Minimum Required Clearance</u>
0-50	10 feet
51- 200	15 feet
201-300	20 feet
301-500	25 feet
501-750	35 feet
751-1000	45 feet

5.2.8 Work Area Protection

As the project operations may be undertaken in a roadway or parking lot, motor vehicles may be a hazard. Guidance on properly coning and flagging the work area is located in Attachment C. Consideration should be given to parking a work vehicle within the coned area between the work area and oncoming traffic. Procedures for work zone traffic control are located in Safety Management Standard 32, a copy of which is to be maintained on site.

5.2.9 Trenching and Excavation

All URS personnel are prohibited from entering a trench or excavation until a competent person in accordance with 29 CFR 1926.650-651 has inspected it. If personnel are required to enter a trench or excavation that is deeper than **four** feet, the contractor who created the excavation must provide the following provisions prior to entry:

- If hazardous atmospheres are suspected, any trench or excavation more than four feet deep must be monitored.
- Adequate shoring, sloping, boxing, or benching techniques must be employed.
- Adequate means of employee access and egress must be utilized.
- The contractor's trained, competent person must inspect the trench or excavation on a daily basis, before work commences and on an as-needed basis throughout the day.

A copy of the Fed-OSHA Excavation Standard can be obtained from the Regional Health and Safety Manager. All provisions of this regulation must be complied with when working in a trench or excavation. Additional information regarding URS procedures for excavation activities are located in Safety Management Standard 13. ***Work involving trenches and excavations at the site are anticipated during this phase of the investigation. However, no URS personnel or subcontractor will enter the excavations for any reason.***

5.2.10 Hand Augering

Muscle strains can occur with hand augering. To minimize the occurrence of injury, the following should be observed:

- Keep augers sharp – a dull auger requires more work to advance through the soil.
- Before beginning work, stretch or warm up the body as you would prior to exercising.
- Try to avoid excessive twisting or wrenching motions when using the auger.

5.2.11 Work Near Water

Field work during this investigation includes collecting surface water and sediment samples from one small river. No boats will be used during this investigation. Section 5.3.2 describes biological hazards that may be found. Additional information regarding water safety is in SMS-27. If a boat is required for the collection of surface water and/or sediment samples work will be halted on the Task until an addendum can be provided to the health and safety plan.

5.3 BIOLOGICAL HAZARDS

Potential biological hazards at this site include:

- Blood Borne Pathogens (SMS-051)
- Vector Borne diseases (SMS-47)

5.3.1 Blood Borne Pathogens

Blood Borne pathogens (BPs) include diseases that can be transmitted by contact with blood or other bodily fluids. Universal precautions should be used when administering first-aid. Good hygiene and proper decontamination of non-disposable PPE will minimize potential for transmission of BPs. Additional information regarding URS' procedures for BPs are in SMS-51.

5.3.2 Vector Borne Diseases

Vector borne pathogens are diseases that are transmitted by an insect or animal and include lyme disease (ticks) and rabies (infected animals). Field work on this project includes collecting samples in open, wooded, grassy, and wetland areas. To minimize the risk of contracting a vector borne disease:

- Wear light-colored field clothing;
- Use insect repellants;
- Do not approach stray or wild animals.

Additional information regarding URS procedures for minimizing risks of biological hazards are in SMS-47.

6.0 EXPOSURE MONITORING PLAN

Heat stress, noise, and chemical exposures may be encountered at this site. Heat stress monitoring and prevention is addressed in Section 5.2.1. Noise levels will not be monitored; URS personnel will wear hearing protection as described in Section [5.2.3].

6.1 CHEMICAL EXPOSURE MONITORING

The field instrumentation described in this health and safety plan has been specifically selected for the contaminants that may be reasonably anticipated to be encountered during this course of this project. Selection factors include anticipated airborne concentrations, potential interference, ionization potentials, instrument sensitivity, and occupational exposure limits. The Action Levels specified in Section 1.0 were established with the expectation that specific instruments will be used. **DO NOT SUBSTITUTE INSTRUMENTS WITHOUT THE CONSENT OF THE HSP PREPARER OR THE REGIONAL HEALTH AND SAFETY MANAGER.**

The monitoring equipment specified in Section 1.0 will be used on a regular basis to evaluate the potential for exposure to airborne contaminants, typically every five to ten minutes. Monitoring will be conducted in the immediate vicinity of the contaminant source point or work area (e.g., at the borehole and cuttings adjacent to the borehole). If readings exceed the first Action Level (> 5 ppm > one minute), monitoring in the operator's breathing zone (OBZ) of the person working nearest the point of operations/contaminant source will start immediately, and site personnel will don protective clothing.

A reading in the OBZ above the second Action Level (15 - 50 ppm > one minute) will require the use of full-face respirators (APR) with combination organic/P100 cartridges. An OBZ reading above the third Action Level (> 50 ppm > one minute), work will stop, and workers will move upwind while the airborne contaminants dissipate. If elevated levels remain for more than five minutes, the source of the airborne contamination will be covered with clean soil, plastic sheeting, or foam, (or controlled in an appropriate manner) and the Health and Safety Representative or PM will be contacted for further guidance.

6.1.1 Personal Exposure Monitoring

In accordance with 29 CFR 1910.120(h), a URS industrial hygienist will perform quantitative personal monitoring on personnel at greatest risk of exposure (i.e., those working in the exclusion zone). The industrial hygienist will determine who to sample based upon site conditions at the time of the sampling; monitoring will commence when the Second Action Level is exceeded.

Personnel will be monitored for potential chemical *exposure* in accordance with OSHA or National Institutes for Occupational Safety and Health (NIOSH) methodology. Potential sampling parameters include benzene and other VOCs. A laboratory accredited by the American Industrial Hygiene Association will perform analyses, and results will be reported and records maintained in accordance with OSHA criteria.

Procedures for personal monitoring are located in Safety Management Standard 43, a copy of which is to be maintained on site.

6.2 BACKGROUND READINGS

All direct-reading instrument readings will be evaluated relative to background reading, not "meter zero". Prior to the start of work at each shift, and whenever there is a significant shift in wind direction, instrument readings will be obtained upwind of the site work zone in order to determine the level of "background" readings from local vehicle traffic, emissions from nearby operations unrelated to the site, etc. Site readings will be evaluated against these background readings (i.e., if an action level is listed as 20 ppm, it is evaluated as 20 ppm above background). The SSO should consult with the industrial hygienist regarding the potential health hazards associated with background readings above 5 ppm.

6.3 DATA LOGGING

All monitoring data, including background readings, will be logged in the field logbook. The results of daily instrument calibrations can either be logged on the form provided in Attachment C or in the field logbook. All monitoring instruments will be calibrated in accordance with the manufacturer's instructions prior to the start of each shift. Calibration should also be performed when inconsistent or erratic readings are obtained. **IF AN INSTRUMENT CANNOT BE CALIBRATED TO SPECIFICATION, OR BECOMES OTHERWISE INOPERABLE OR UNRELIABLE, ALL INVASIVE SITE WORK (I.E., DRILLING, EXCAVATING) WILL CEASE UNTIL THE INSTRUMENT IS APPROPRIATELY REPAIRED OR REPLACED;** the PM or Regional Health and Safety Manager should be contacted for further guidance.

6.4 DUST CONTROL

High winds and site operations can cause airborne dust hazards. If site operations generate sustained visible dust, a water mist will be applied to reduce dust generation. If the mist is not effective in reducing dust generation, personnel will don respirators with combination organic vapor-P100 cartridges (such as MSA's GMC-H cartridges).

Sand and Portland cement that may be used in groundwater monitoring well construction may contain free silica (quartz). Airborne exposure to silica dust may occur during handling of these materials. Respirators with P100 cartridges must be worn for those sand and cement handling operations where there is a reasonable possibility for exposure to sustained airborne dust from the pouring and mixing of dry sand or cement.

6.5 EXPLOSIVE ATMOSPHERES

Due to the presence of elevated concentrations of site constituents that have a low flash point, the potential exists for explosive atmospheres at the site. Therefore, a Combustible Gas Indicator/O₂ (CGI/O₂) meter will be used to monitor ambient conditions. Decisions will be based on the

levels measured using a CGI/O₂ meter (measurements are in % of the Lower Explosive Limit) as determined by the Action Level Table located on **page 6**.

For excavation operations, a CGI with a remote sensing head should be used. The sensing head should be attached to the excavator arm near the bucket, and the cable run back along the arm to the CGI located in the excavator cab. This will permit the operator to be alerted to hazardous situations without requiring monitoring personnel to stand at the working face.

Fire suppression equipment (Two 2A10B:C fire extinguishers or fire hoses) is to be present at all times during site operations in areas where a fire potential exists.

6.6 OXYGEN DEFICIENT ATMOSPHERES

Oxygen deficient atmospheres may be encountered in excavations. An excavation with an oxygen deficient atmosphere is not to be entered unless absolutely necessary and then only after following appropriate confined space entry procedures. These procedures are available by contacting the Regional Health and Safety Manager to obtain a confined space entry permit. Any confined space entry must be approved by the Regional Health and Safety Manager.

Prior to entering any space where an oxygen deficiency may exist, an oxygen meter will be used to test for adequate oxygen levels. Decisions will be based on oxygen concentrations as follows:

20.9%	Continue Operations
<20.9%	Continuous Monitoring with caution noted to entrants
<19.5%	Do not enter, ventilate and determine if supplied air equipment is required
greater than 21%	Potential oxygen-rich atmosphere, consult with health and safety staff

7.0 PERSONAL PROTECTIVE EQUIPMENT

The minimum Personal Protective Equipment (PPE) for site personnel includes:

- Hardhat (ANSI-rated)
- Safety glasses with side shields (or impact resistant goggles)
- Steel-toed boots or (Neoprene) Chemical-resistant steel-toed boots (ANSI-rated)
- Ear protection in vicinity of noisy equipment
- Work gloves and/or chemical-resistant gloves
- Tyvek coveralls coated or uncoated, as appropriate) and nitrile gloves when handling potentially contaminated materials
- Traffic safety vest in the vicinity of heavy equipment

As the various monitoring Action Levels are reached, additional PPE is required. Section 1.0 provides the description of the incremental PPE requirements relative to specific Action Levels, as well as the specific kinds of PPE to be used. Procedures for use and selection of personal protective equipment are located in Safety Management Standard 29, a copy of which is to be maintained on site.

7.1 LIMITATIONS OF PROTECTIVE CLOTHING

The protective equipment ensembles selected for this project are anticipated to provide protection against the types and concentrations of hazardous materials that may potentially be encountered during field operations. However, no protective garment, glove or boot is resistant to all chemicals at any concentration; in fact, chemicals may continue to permeate or degrade a garment even after the source of the contamination is removed.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all URS personnel:

- When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift
- Inspect all clothing, gloves and boots both prior to and during use for:
 - Imperfect seams
 - Non-uniform coatings
 - Tears
 - Poorly functioning closures
- Inspect reusable garments, boots and gloves both prior to and during use for:
 - Visible signs of chemical permeation such as swelling, discoloration, stiffness or brittleness
 - Cracks or any signs of puncture or abrasion

Any reusable garments exhibiting any such characteristics will be discarded.

7.2 DURATION OF WORK TASKS

The duration of work tasks in which personnel use PPE ensembles that include chemical protective clothing (including uncoated Tyvek®) will be established by the SSO. Variables to be considered include ambient temperature and other weather conditions, the capacity of individual personnel to work in the required level of PPE in heat and cold, and the limitations of specific PPE ensembles. The recommended rest breaks are as follows:

- Fifteen minutes midway between shift startup and lunch
- Lunch break (30-60 minutes)
- Fifteen minutes midway between lunch and shift end

Rest breaks are to be taken in the support zone or other clean area after personnel have completed the decontamination process, including soap and water wash of hands and face. *[Additional rest breaks will be scheduled according to heat stress monitoring protocols as described in SMS 18.]*

8.0 RESPIRATORY PROTECTION

8.1 RESPIRATOR SELECTION

Engineering controls and safe work practices (e.g. elimination of the source of contamination, ventilation equipment, working upwind, limiting exposure time, etc). must always be the primary control for air contaminants. Respirators will be used if engineering or work practice controls are not feasible for controlling airborne exposures below acceptable concentrations and as an interim control measure while engineering or work practice controls are implemented.

Once the need for respirators has been established, the respirators will be selected on the basis of the hazards to which the worker is exposed. Only NIOSH-approved respirators will be issued. Selection criteria established in 29 CFR 1910.134 has been used by the HASP Preparer in determining respirator requirements for this project.

CAUTION: Full-face piece or half-face piece air-purifying respirators are not to be used where there is an oxygen deficiency. Only air-supplied respirators with an emergency escape cylinder or self-contained breathing apparatus will be worn when an oxygen deficiency exists.

CAUTION: A respirator does not protect against excessive heat or against hazardous substance that can attack the body through the skin, such as cyanides.

The forms of the airborne contaminants have been evaluated based upon the suspected contaminants of concern. Evaluation of the concentration of the airborne chemical hazard will be performed using direct reading instruments to determine what type respirator will be used. Airborne readings will be compared to Action Levels in the table in Section 1.0. See action level/respirator requirements in Section 6.1.

8.2 MEDICAL SCREENING

Project employees are enrolled in the URS Medical Surveillance Program and are medically evaluated in compliance with the requirements of 29 CFR 1910.134(a)(10). Employees not medically cleared to wear respirators will not be assigned to this project.

The medical status of each employee is reviewed annually and as may be deemed necessary by the examining physician if the physical status of the employee changes.

8.3 FIT TESTING

A person wearing a respirator must be clean-shaven in the area of the face piece seal. Long hair, sideburns, and skullcaps that extend under the seal are not allowed. Glasses with temple pieces extending under the seal are not allowed for full-face respirators. Persons with facial conditions that prevent a proper seal are not allowed to wear a respirator until the condition is corrected.

Facial conditions that may cause a seal problem include missing dentures, scars, severe acne, etc. Contact lenses may be worn with respiratory protection.

No individual will enter an area where the use of respiratory protective equipment is required unless the person has been fit tested within the last year. Fit testing will be performed in accordance with accepted fit test procedures defined in Safety Management Standard 42, a copy of which is maintained at the site.

Records of fit testing will be maintained on site or by the employee's office and/or corporate medical surveillance program.

Respirator wearers will perform a user seal check each time the respirator is put on. For air purifying respirators, the positive user seal check is performed by first removing the exhalation valve cover, then placing the palm over the respirator exhalation valve and exhaling gently. The respirator mask should puff out without noticeable leakage. The negative user seal check is performed by placing the palms over both of the respirator cartridges, inhaling gently, and holding the breath for 10 seconds. The respirator mask should remain collapsed on the face without noticeable leakage.

8.4 RESPIRATOR USE INSTRUCTIONS

Only those employees who have been properly trained and qualified on the specific type of respirator to be worn may use respirators. No individual will enter an area where the use of respiratory protective equipment is required unless the person has been trained.

All employees whose job assignment requires the use of respirators are given training in accordance with 29 CFR 1910.134 during initial 40-hour and annual Refresher training for hazardous waste operations.

Hands-on training on inspecting and donning a respirator, including user seal checks, was also provided at the time of fit testing. Retraining is performed annually on each type of respirator worn by the individual. In addition, site-specific respirator training is provided during Site Safety Briefings conducted by the SSO. Training records are kept in the employee's training file.

Particulate respirator cartridges should be changed out when the wearer has difficulty breathing through the cartridges. Chemical gas or vapor respirator cartridges will be ***changed out at least daily***.

The fit of a chemical gas or vapor respirator should be rechecked and the cartridges changed if the wearer detects chemical odor or feels chemical irritation on the skin, both indicators of leakage or cartridge breakthrough. Where available, an ESLI will be used on chemical respirator cartridges. Cartridges will be changed as soon as the ESLI indicates that the cartridge is saturated and no longer effective in absorbing airborne chemicals.

8.5 RESPIRATOR INSPECTION

The user will inspect respirators before and after each day's use.

Inspection procedure, air purifying respirators (full-face piece and half-face piece cartridge respirators):

Examine the face piece for:

- Excessive dirt
- Cracks, tears, holes, or distortion from improper storage
- Inflexibility
- Cracked or badly scratched lenses (full-face only)
- Incorrectly mounted eyeglass lenses or broken or missing mounting clips (full-face only)
- Cracked or broken air purifying element holder, badly worn threads, or missing gaskets

Examine the head straps or head harness for:

- Breaks or cracks
- Broken or malfunctioning buckles
- Excessively worn serration on the headstraps, which may permit slippage

Examine the inhalation valves (2) and exhalation valve for:

- Foreign material (e.g. hairs, particles, etc.)
- Improper insertion of the valve body in the face piece
- Cracks, tears, or chips in the valve body, particularly in the sealing surface
- Missing or defective exhalation valve covers

Examine the air-purifying cartridge for:

- Missing or worn cartridge holder gasket
- Incorrect cartridge/canister for the hazard
- Incorrect cartridge installation, loose connections, or cross threading in the holder
- Cracks or dents in the outside case or threads of filter or cartridge/canister

8.6 CLEANING OF RESPIRATORS

Respirators assigned and worn by one individual must be dismantled and thoroughly cleaned and disinfected after each day's use. Visitor's or multi-assigned respirators must be cleaned and disinfected after each use. A disinfectant spray or wipe is approved as a disinfectant between uses during the day but not for cleaning and sanitizing after each day's use. Care must be taken

to prevent damage from rough handling during the cleaning procedure. After cleaning, respirators must be reassembled.

Respirator Cleaning Procedure

- Washing:** Disassemble and wash with a mild liquid detergent in warm water (not to exceed 110°F). A stiff bristle (not wire) brush may be used.
- Rinsing:** Rinse in clean water (110°F maximum) to remove all traces of detergent. This is very important to prevent dermatitis.
- Disinfecting:** Thoroughly rinse or immerse in a sanitizer provided by the manufacturer. Alternatively, a weak chlorine bleach solution (1 milliliter liquid bleach/liter of water) may be used.
- Final Rinsing:** Rinse thoroughly in clean water (110°F maximum) to remove all traces of disinfectant. This is very important to prevent dermatitis.
- Drying:** Drain and dry hanging by the straps from racks (take care to prevent damage) or towel drying with clean soft clothes or paper towels.

8.7 MAINTENANCE OF RESPIRATORS

Routine respirator maintenance such as replacing missing valves, gaskets, nose cups etc., must only be performed by trained respirator users or a respirator manufacturer's representative. Only approved replacement parts must be used. Substitution of parts from a different brand or type of respirator is generally not possible, invalidates the technical approval of the respirator, and is not permitted. Any respirator suspected of being defective must be removed from service and replaced.

8.8 STORAGE OF RESPIRATORS

When not in use, respirators must be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and physical damage. Respirators must be stored in sealable (e.g. Ziplock® or twist-tie) reusable plastic bags between shifts.

The respirator storage environment must be clean, dry, and away from direct sunlight. Onsite cabinets or cases are suggested. Storing bagged respirators in vehicles is discouraged due to the potential for damage from other material or equipment.

8.9 ADDITIONAL INFORMATION

Additional information on the URS Respiratory Protection Program is located in Safety Management Standard 42, a copy of which is to be available on site.

9.0 SITE CONTROL

9.1 GENERAL

Barricade tape and/or barricades shall be used to delineate a work zone for safety purposes around the work area. The barriers should be set in a 25-foot radius (as practical) around the work area to provide sufficient maneuvering space for personnel and equipment. A short piece of barricade tape can be affixed to a secure upright (e.g., drill rig mast or vehicle antenna) to serve as a wind direction telltale. A five-foot opening in the barricades at the support zone (upwind of the work area) will serve as the personnel and equipment entry and exit point. The personnel decontamination station will be established at this point if formal decontamination procedures are required (see Section 9.0). All entry and exit from the work area will be made at this opening in order to control potential sources of contamination and leave contaminated soil and debris in the work area.

At the end of the shift, all boring/sampling holes and excavations must be covered or otherwise secured. All cuttings and decontamination fluids are to be handled in accordance with relevant regulations and instructions from the PM.

The PM or SSO (*with the assistance of the facility representative*) will determine an upwind evacuation area prior to each shift, and all personnel will be notified of its location. A horn or other signaling device will be used to signal an evacuation in the event of an emergency. Three blasts of the horn will be the signal to immediately stop work and proceed to the evacuation area.

The SSO will verify that all site visitors sign the visitors' log. In addition, all URS personnel and site visitors entering the work area must present evidence of their participation in a medical surveillance program and completion of health and safety training programs that fulfill the requirements of this plan.

The SSO will provide site hazard and emergency action information to all site visitors before they enter the site. This can be done by providing a copy of this HSP to the visitor.

9.2 WORK ZONES

If monitoring instrument readings exceed the first Action Level (5ppm > one minute), requiring the use of chemical protective equipment, work zones must be established as described below.

- Exclusion Zone – a 25 foot (as practical) circle around the work area will be defined before work starts. The encircled area will constitute the “Exclusion Zone”. This zone is where potentially hazardous contaminants and physical hazards to the workers will be contained. Appropriate personal protection as described in Section 1.0 will be required in this area. Plastic sheeting (visqueen) and/or tarps may be used as necessary to control contaminated materials spilled to the ground during site operations. The size of the Exclusion Zone may be altered to accommodate site conditions and to ensure contaminant containment.

- Contamination Reduction Zone (CRZ) – a corridor leading from the Exclusion Zone will be defined, and will lead from the work area to a break area. All decontamination activities will occur in the CRZ. A waste container will be placed at the end of the corridor so contaminated disposable equipment can be placed inside and covered. Surface/soil contamination in this area should be controlled using plastic sheeting. No one will be permitted into the Contamination Reduction Zone or Exclusion Zone unless they are in full compliance with the requirements of this Plan.
- Support Zone – a Support Zone, the outermost part of the site, must be defined for each field activity. Support equipment is located in this uncontaminated or clean area. Normal work clothes are appropriate within this zone. The location of this zone depends on factors such as accessibility, wind direction (upwind of work area), and resources (i.e., roads, shelter, utilities).

10.0 DECONTAMINATION PROCEDURES

If the monitoring instrument readings indicate respirator use (the Second Action Level [15-50 ppm > one minute]) in the Operator's Breathing Zone, the following steps will be followed whenever personnel leave the exclusion zone/work area:

1. Remove all equipment, sample containers, and notes to the CRZ. Obtain decontamination solutions and decon tools (shovels, auger flights, etc.) by brushing them under a water rinse. A high-pressure steam cleaner may also be used for decon. All waste and spent decon solutions will be properly contained.
2. Scrub boots with a stiff bristle brush and water. Washtubs and chairs will be provided.
3. Remove outer gloves (and boot covers, if used).
4. Remove Tyvek[®] coverall; discard in provided container.
5. Remove hardhat and eye protection.
6. Remove respirator.
7. Remove inner gloves.
8. Wash hands and face.

The decontamination area will be covered with plastic sheeting, which will be replaced when torn or heavily soiled, and at the end of each shift.

Each worker will be responsible for cleaning, sanitizing and storing their own respirator in accordance with manufacturer's guidance (i.e., washing in warm water and detergent or sanitizing solution, air drying, and storing in a plastic storage bag; see Sections 8.6 - 8.8). Cartridges will be changed in accordance with the procedures described in Section 8.4.

All spent decontamination fluids (rinse waters, etc.) shall be handled as directed by the PM and in accordance with relevant regulations.

10.1 SANITATION

Potable water will be made available at the site, either from a pressurized source or commercially available bottled water. Drinking cups will be supplied so personnel will neither drink directly from the source of water nor have to share drinking cups. Sources of non-potable water shall be clearly labeled as such.

Unless toilet facilities are available on site or transportation is readily available to transport personnel to nearby (within five minutes) toilet facilities, portable toilet facilities, such as chemical toilets, will be provided on site.

Washing facilities will be provided on site, and will be located in the decontamination area or the support area. Soap, clean water, wash basins and single-use towels will be available for personnel use.

URS procedures for site sanitation are located in Safety Management Standard 30, a copy of which is to be maintained on site.

10.2 DECONTAMINATION – MEDICAL EMERGENCIES

In the event of physical injury or other serious medical concerns, immediate first aid is to be administered in lieu of further decontamination efforts.

See Emergency Decontamination chart for a decision tree for emergency decontamination.

10.3 DECONTAMINATION OF TOOLS

A decontamination pad will be set up for steam cleaning the drilling rig and tools. If steam cleaning does not remove the coal tar, then Citru-Solv will be used as a solvent, followed by soap and water rinses, and steam cleaning as necessary. Measures will be taken to contain the mud and fluids at the drill rig by drilling through plywood sheeting or a mud box. Some tools (split-spoon samplers) may be decontaminated near the drill rig over buckets, large enough to containerize all of the rinse waters.

When all work activities have been completed, contaminated tools used by URS personnel will be either appropriately decontaminated or properly disposed of as hazardous waste.

It is expected that all tools will be constructed of non-porous, non-absorbent materials. This will aid the decontamination process. Any tool, or part of a tool, which is made of a porous/absorbent material will be discarded and disposed of as a hazardous waste if it cannot be properly decontaminated.

Tools will be placed on a decontamination pad or into a bucket and thoroughly washed using a soap solution and brushing, followed by a fresh water rinse. All visible particles are to be removed before the tool is considered clean.

11.0 SAFE WORK PRACTICES

11.1 GENERAL

1. Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.
2. All personnel will enter designated work areas only through the contamination reduction zone (CRZ). All personnel leaving an exclusion/work zone must exit through the CRZ and pass through the decontamination station as described in Section 10.0.
3. Personnel will wash their hands and face thoroughly with soap and water prior to eating, drinking or smoking. Furthermore, at the end of each work day personnel will change into uncontaminated clothing before leaving the work premises.
4. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling, leaning or sitting on contaminated surfaces. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc.)
5. All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved (i.e., presence of strong, irritating or nauseating odors).
6. Only those vehicles and equipment required to complete work tasks should be permitted within the exclusion/work zone (drill rigs, excavators, and similar items). All non-essential vehicles should remain within the support zone.
7. Containers, such as drums, will be moved only with the proper equipment and will be secured to prevent dropping or loss of control during transport.
8. Field survey instruments, such as PIDs, should be covered with plastic or similar covering to minimize the potential for contamination.
9. No matches or lighters will be permitted in the work area/exclusion zone or contamination reduction zone.
10. Contaminated protective equipment, such as respirators, hoses, boots, and disposable protective clothing, will not be removed from the work area/exclusion zone or decontamination area until it has been cleaned, or properly packaged and labeled.

11. Prevent, to the extent possible, spills. In the event that a spill occurs, contain liquid if possible.
12. Prevent splashing of the contaminated materials.
13. Field crewmembers shall be familiar with the physical characteristics of the site operations including:
 - Wind direction in relation to the contaminated area;
 - Accessibility to equipment and vehicles;
 - Areas of known or suspected contamination;
 - Site access; and
 - Nearest water sources.
14. The number of personnel and equipment in the exclusion zone should be minimized but only to the extent consistent with workforce requirements of safe site operations.
15. All wastes generated by URS activities at the site will be disposed of as directed by the PM.
16. All personal protective equipment will be used as specified and required.
17. The buddy system will be used at all times when performing sampling for hazardous material when the first action level criteria has been exceeded or when working in remote areas.
18. Personnel are to immediately notify the SSO or Site Manager if any indications of potential explosions or unusual conditions are observed.

11.2 SAMPLING PRACTICES

For all sampling activities, the following standard safety procedures shall be employed:

1. All sampling equipment should be cleaned before proceeding to the site.
2. At the sampling site, sampling equipment should be cleaned after each use.
3. Work in “cleaner” areas should be conducted first where practical.
4. All unauthorized personnel will remain outside exclusion zones at all times.

11.3 SAMPLE SHIPMENT/HAZARDOUS MATERIALS SHIPMENT

If samples to be collected during the course of this project fall under the criteria that defines them as hazardous materials under DOT regulations 49 CFR Parts 171-177 (see URS guidelines

for determination), then they must be shipped in accordance with those regulations by an individual who is certified as having been trained as required under the DOT /IATA regulations.

12.0 EMERGENCY RESPONSE PLAN

It is URS policy to evacuate personnel from areas involved in hazardous material emergencies and to summon outside assistance from agencies with personnel trained to respond to the specific emergency. This section outlines the procedures to be followed by URS personnel in the event of a site emergency. These procedures are to be reviewed during the onsite safety briefings conducted by the SSO.

In the event of a fire or medical emergency, the emergency numbers identified in Section 1.0 (page 1) can be called for assistance.

12.1 PLACES OF REFUGE

In the event of a site emergency requiring evacuation, all personnel will evacuate to a pre-designated area located a safe distance from any health or safety hazard (typically the URS field office, unless conditions dictate otherwise). The SSO (*in cooperation with a facility representative*) will designate a primary assembly area prior to the start of work each day. The daily pre-designated assembly area may have to be re-designated by the SSO in the event of an emergency where the area of influence affects the primary assembly area. Once assembled, the SSO shall take a head count. The SSO will evaluate the assembly area to determine if the area is outside the influence of the situation; if not, the SSO will redirect the group to a new assembly area where a new head count will be taken.

During any site evacuation, all employees shall be instructed to observe wind direction indicators. During evacuation, employees will be instructed to travel upwind or crosswind of the area of influence. The SSO will provide specific evacuation instructions, via the site emergency radio if necessary, to site personnel regarding the actual site conditions.

12.2 FIRE

Fire prevention procedures are described in Safety Management Standard 14, a copy of which is to be maintained on site. To protect against fires, the following special precautions must be taken:

- Before any flame-producing devices, i.e., cutting torches or welding irons, are used in the exclusion zone, the SSO must be contacted. In some cases, the client may require to be contacted as well to determine if a hot work permit is required. A detailed inspection of the work area will be conducted to determine if potential fire sources exist. The fire sources must be removed to at least 35 feet away before work can commence.
- Two full 2A10B:C fire extinguishers must be located at the work area when cutting/welding is being conducted, and a fire watch will be posted.

- Upon completion of the cutting/welding activities the area will be inspected for hot metal, slag, etc. The fire watch will remain on station for at least 15 minutes after the hot work is completed.

Type ABC fire extinguishers will be available on site to contain and extinguish small fires. The local or facility fire department shall be summoned in the event of any fire on site.

12.3 COMMUNICATION

A communication network must be set up to alert site personnel of emergencies and to summon outside emergency assistance. Where voice communication is not feasible an alarm system (i.e., sirens, horns, etc.) should be set up to alert employees of emergencies. Radio communication may also be used to communicate with personnel in the exclusion zone. Where phone service is not readily available, radios or portable phones should be used to communicate with outside agencies. Site personnel should be trained on the use of the site emergency communication network. Emergency phone numbers shall be posted at the phone or radio used for outside communication. The SSO is responsible for establishing the communication network prior to the start of work, and for explaining it to all site personnel during the site safety briefing.

In the event of an emergency, personnel will use the following hand signals where voice communications are not feasible:

<u>Signal</u>	<u>Definition</u>
Hands clutching throat	Out of air/can't breathe
Hands on top of head	Need assistance
Thumbs up	OK/I'm alright/I understand
Thumbs down	No/negative
Arms waving upright	Send back-up support
Grip partner's wrist	Exit area immediately

12.4 EMERGENCY RESPONSE PROCEDURES

12.4.1 Emergency Response Team

The emergency response team will consist of employees who assume the following roles:

- Emergency Care Provider(s)
- Provide First Aid/CPR as Needed.
- Communicator

The role of the communicator is to maintain contact with appropriate emergency services, providing as much information as possible, such as the number injured, the type and extent of injuries, and the exact location of the accident scene. The communicator should be located as close to the scene as possible in order to transmit

to the emergency care providers any additional instructions that may be given by emergency services personnel in route.

- Site Supervisor

The site supervisor (usually the SSO) should survey and assess existing and potential hazards, evacuate personnel as needed, and contain the hazard. Follow up responsibilities include replacing or repairing damaged equipment, documenting the incident, and notifying appropriate personnel/agencies described under incident reporting. It also includes reviewing and revising site safety and contingency plans as necessary.

In the event of an emergency, follow the procedure outlined in Figure 12-1. Notify site personnel of the situation. Survey the scene to determine if the situation is safe, to determine what happened, and to search for other victims. The Emergency Response Checklist can be used to help remember the things to do in an emergency.

EMERGENCY RESPONSE CHECKLIST

In an Emergency	Yes	No
Confirm the reported incident	_____	_____
Evacuate and secure the area	_____	_____
Render first aid/emergency medical care	_____	_____
Notify promptly:		
Project Manager	_____	_____
Fire Department	_____	_____
Police Department	_____	_____
Nearest Hospital or Medical Care Facility	_____	_____
Start Documentation	_____	_____
If spill or leak occurs:		
Don the proper PPE	_____	_____
Stop the source	_____	_____
Contain the spill	_____	_____
Clean up the spill	_____	_____
Upon evacuating, take attendance at the assembly area	_____	_____
Authority given:		
Leave the site	_____	_____
Restart the operations	_____	_____
Debrief and document the incident	_____	_____
A copy of the document submitted to the HSM	_____	_____

12.5 MEDICAL EMERGENCY RESPONSE PLAN

At least one URS employee on site will hold a current certificate in American Red Cross Standard First Aid. This training provides six and one-half hours of Adult CPR and Basic First Aid. If a medical emergency exists, consult the emergency phone number list and request an ambulance immediately. Perform First Aid/CPR as necessary, stabilize the injured, decontaminate if necessary, and extricate only if the environment they are in is dangerous or unsafe and ONLY if the rescuers are appropriately protected for potential hazards they may encounter during the rescue. When emergency services personnel arrive, communicate all first aid activities that have occurred. Transfer responsibility for care of the injured/ill to the emergency services personnel.

The following items and emergency response equipment will be located within easy access at all times:

- First Aid Kit and Infection Control Kit;
- Eyewash – A 15 minute eyewash (required if corrosives are present) or an appropriate amount of portable sterile eyewash bottles will be available on site for flushing foreign particles or contaminants out of eyes. The SSO will demonstrate the proper operation of the unit(s) prior to the start of work;
- Emergency Phone Numbers List; and
- Portable radios for emergency communications in remote areas.

Drugs, inhalants, or medications shall not be included in the First Aid Kit.

Supplies should be re-ordered as they are used. A monthly inventory must be done on the first aid kit and infection control kit contents and supplies re-ordered that have been used and not reported.

12.6 INCIDENT REPORT

ALL site injuries and illnesses must be reported to the SSO and PM immediately following first-aid treatment. The SSO will notify the Regional Health and Safety Manager (**Steven Sherman at 716-856-5636**). Work is to be stopped until the PM or SSO and RSO have determined the cause of the incident and have taken the appropriate action to prevent a reoccurrence. Any injury or illness, regardless of severity, is to be reported. (see SMS #49).

12.7 OPERATION SHUTDOWN

Under certain extreme hazardous situations the SSO or SSR may request that site operations be temporarily suspended while the underlying hazard is corrected or controlled. During operation shutdown, all personnel will be required to stand upwind to prevent exposure to fugitive

emissions. The SSO, with concurrence from the Regional Health and Safety Manager, will have ultimate authority for operations shutdown and restart.

12.8 SPILL OR HAZARDOUS MATERIALS RELEASE

Small spills are immediately reported to the SSO and are dealt with according to the chemical manufacturer's recommended procedures found on the MSDS. Steps will be taken to contain and/or collect small spills for approved storage and disposal.

In the unlikely event of a larger release of hazardous materials as a result of site activities, site personnel will evacuate to the predesignated assembly area. The local Designated Emergency Response Authority (DERA) will be notified by the SSO immediately and appropriate actions will be taken to protect the public health and mitigate the contaminant release. The DERA can be reached through the local police or fire department. The Site Manager will make the following emergency contacts:

Regional Health and Safety Manager	Steven Sherman	716-856-5636
Health and Safety Representative	Thomas Shine	518-688-0015
Project Manager	Jack Wilcox	716-856-5636
EPA Response Center (depending if RQ is exceeded)		(800) 424-8802

13.0 TRAINING, MEDICAL SURVEILLANCE, SITE INSPECTIONS

13.1 TRAINING AND MEDICAL SURVEILLANCE

All URS site personnel will have met the requirements of 29 CFR 1910.120(e), including:

- Forty hours of initial off-site training or its recognized equivalent
- Eight hours of annual refresher training for all personnel (as required);
- Eight hours of supervisor training for personnel serving as Site Safety Officers
- Three days of work activity under the supervision of a trained and experienced supervisor

All URS site personnel are participating in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Current copies of training certificates and statements of medical program participation for all URS personnel are maintained by the local office.

In addition, all URS site personnel will review this HSP and sign a copy of the Safety Plan Compliance Agreement, which is found in Attachment B. The PM will maintain these agreements at the site, and place them in the project file at the conclusion of the operation.

Prior to the start of operations at the site, the SSO will conduct a site safety briefing, which will include all personnel involved in site operations. At this meeting, the SSO will discuss:

- Contents of this HSP
- Types of hazards at the site and means for minimizing exposure to them
- The type of monitoring that will be performed
- Action levels for upgrade and downgrade of personal protective equipment
- Personal protective equipment that will be used
- Site-specific respiratory protection requirements
- Decontamination protocol
- Site control measures, including safe operating practices and communication
- Location and use of emergency equipment
- Evacuation signals and procedures

All site personnel, including subcontractor personnel, are to attend the briefings and sign the briefing form.

Subsequent site safety briefings will be conducted at least weekly, or whenever there is a change in task or significant change in task location. Briefings will also be conducted whenever new personnel report to the site.

13.2 SITE INSPECTIONS

The URS Site Manager or Site Safety Officer is to conduct a daily site inspection prior to the start of each shift. It is the responsibility of the Project Manager or Site Manager to resolve discrepancies immediately, contacting the Regional Health and Safety Manager if necessary for assistance. Inspections are to be documented and maintained on site until the completion of the project, at which time they are placed in the project files.

14.0 RECORDKEEPING

The PM and SSO are responsible for site recordkeeping. Prior to the start of work, they will review this plan; if there are no changes to be made, they will sign the approval form (PM) or acceptance form (SSO) and forward a copy to the Regional Health and Safety Manager.

All URS personnel will review the HSP and sign the Safety Plan Compliance Agreement in Attachment D; copies of these forms will be maintained in the project file as noted in Section 12.

The SSO will conduct a Site Safety Briefing in accordance with Section 13 and have all attendees sign the form in Attachment D; copies will be maintained in the project file.

Any incident or exposure incident will be investigated and the Incident Report form (Attachment D) will be completed and forwarded to the Office Human Resources Representative and the Regional Health and Safety Manager.

All instrument readings and calibrations, PPE use and changes, health and safety-related issues, and deviations from or problems with this HSP will be recorded in the field log.

ATTACHMENT A
HOSPITAL ROUTE MAP

[Yahoo!](#) [My Yahoo!](#) [Mail](#)**YAHOO! GetLocal**
Maps[Sign In](#)
New User? [Sign Up](#)Search
the web

Mz

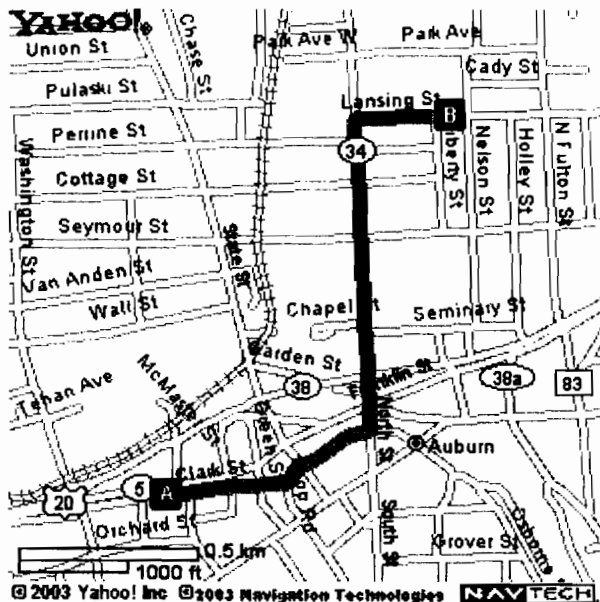
Starting from: **A** Clark St, Auburn, NY 13021Arriving at: **L** 17 Lansing St, Auburn, NY 13021-1983

Distance: 1.1 miles Approximate Travel Time: 2 mins

Directions

1.	Start at [46-68] CLARK ST, AUBURN going towards JAMES ST - go 0.2 mi
2.	Turn L on LOOP RD - go < 0.1 mi
3.	Continue on DILL ST - go 0.1 mi
4.	Turn L on NORTH ST - go 0.5 mi
5.	Turn R on LANSING ST - go 0.2 mi
6.	Arrive at 17 LANSING ST, AUBURN

When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

Full Route**Destination**

17 Lansing St
Auburn, NY 13021-1983

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ATTACHMENT B

SAFETY PLAN COMPLIANCE AGREEMENT AND MEDICAL EMERGENCY CONTACT SHEET

I, _____, have received a copy of the Health and Safety Plan for this Project. I have reviewed the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the health and safety requirements specified in the plan.

SIGNED: _____
Signature Date

Firm: URS Corp.

This brief Medical Emergency Contact Sheet will be kept in the Support Zone during site operations. It is in no way a substitute for the Medical Surveillance Program requirements of the URS Health and Safety Program. This data sheet will accompany injured personnel when medical assistance or transport to hospital facilities is necessary.

Emergency Contact: _____ Phone #: _____

Relationship: _____

Do you wear contact lenses? _____

—

—

—

ATTACHMENT C

SAFETY MANAGEMENT STANDARDS

URS SAFETY MANAGEMENT STANDARD

Worker Right-to-Know (Hazard Communication)

1. Applicability

This procedure applies to URS office and field operations.

2. Purpose and Scope

The worker right-to-know program provides URS personnel with information and training about safety and health hazards associated with the chemicals they might encounter in the workplace. This procedure describes how chemical safety hazards are communicated to URS personnel working in offices and at field site locations, and how information is to be provided to employees of other employers working at the location. The requirements include steps to acquire this information, maintain it, and train everyone to use it.

3. Implementation

Office Locations: Implementation of this program is the responsibility of the Office Manager.

Field Activities: Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Hazardous Material Inventory

1. Maintain a hazardous material inventory that lists all of the hazardous materials used at this workplace. Use chemical names consistent with the applicable MSDS's.
2. File a copy of the chemical inventory in the Safety Filing System.

B. Material Safety Data Sheets (MSDS's)

1. Obtain a MSDS for each chemical before it is used.
2. Review each MSDS when it is received to evaluate whether the information is complete and to determine if existing protective measures are adequate.
3. Maintain a collection of all MSDS's where they are accessible at all times.

URS SAFETY MANAGEMENT STANDARD

Worker Right-to-Know (Hazard Communication)

4. Replace MSDS sheets when updated sheets are received. Communicate any significant changes to those who work with the chemical.
5. MSDS's are required for all hazardous materials used on site by project personnel.

C. Labels

Label all chemical containers with:

1. Identity of the hazardous chemical(s),
2. Appropriate hazard warnings, and
3. Name and address of the chemical manufacturer, importer, or other responsible party.

D. Hazardous Nonroutine Tasks

Periodically, employees are required to perform hazardous non-routine tasks. Prior to starting work on such projects, provide each employee with information about hazards to which they may be exposed during such an activity.

This information will include:

1. Specific chemical hazards.
2. Protective/safety measures which must be utilized.
3. Measures that have been taken to lessen the hazards including ventilation, respirators, presence of another employee and emergency procedures.

E. Informing Contractors/Subcontractors

Provide contractors/subcontractors the following information on chemicals used by or provided to URS personnel:

1. Names of hazardous chemicals to which they may be exposed while on the jobsite.
2. Precautions the employees may take to lessen the possibility of exposure by usage of appropriate protective measures.

URS SAFETY MANAGEMENT STANDARD

Worker Right-to-Know (Hazard Communication)

3. Location of URS MSDS's and written chemical inventory.

F. Training

1. Conduct training of all employees potentially exposed to hazardous materials on the following schedule:
 - a. Before new employees begin their jobs.
 - b. Whenever new chemicals are introduced into the workplace, or
 - c. Annually thereafter.
2. This training will include:
 - a. Applicable regulatory requirements.
 - b. Names of those responsible for implementing this program.
 - c. Location of the program, inventory and MSDS 's.
 - d. Chemicals used, and their hazards (chemical, physical and health).
 - e. How to detect the presence or release of chemicals.
 - f. Safe work practices.
 - g. How to read an MSDS.
3. Document the training.

5. Documentation Summary

A. File these records in the Office Safety Filing System

1. Chemical Inventory.
2. Location of the MSDS inventory.
3. Training records.
4. Contractor/Subcontractor notifications.

B. File these records in the Project Safety File.

URS SAFETY MANAGEMENT STANDARD
Worker Right-to-Know (Hazard Communication)

1. Chemical Inventory.
2. Location of the MSDS inventory.
3. Training records.
4. Contractor/Subcontractor notifications.

6. Resources

- A. U.S. OSHA Technical Links - Hazard Communication
(<http://www.osha-slc.gov/SLTC/hazardcommunications/index.html>)
- B. U.K. - Control of Substance Hazardous to Health - Regulations

URS SAFETY MANAGEMENT STANDARD

CORROSIVE AND REACTIVE MATERIALS

1. Applicability

This program applies to URS office and field operations where corrosive or reactive materials are stored or used.

2. Purpose and Scope

This program provides information regarding the proper methods to store, handle and work with corrosive and reactive materials. This procedure considers a corrosive material as one that has a pH less than 2.0 (acid), or greater than 12.5 (base). A reactive material is a chemical that may be sensitive to shock, or may react with air or water depending upon its makeup.

3. Implementation

Office Locations -Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Appoint a responsible person who will:

1. Inspect storage areas periodically.
2. Monitor the quantity of corrosive and reactive materials on site as well as those incoming materials.
3. Review work practices utilizing corrosive and reactive materials.

B. Require that all employees working with corrosive or reactive materials, or who are working in close proximity to where such materials are being used or handled, are trained in accordance with SMS 2, "Worker Right to Know".

C. Control the use of corrosive and reactive materials by URS personnel.

1. Order only those materials and quantities that are needed to complete a job.
2. Check incoming corrosive and reactive materials for proper labeling.

URS SAFETY MANAGEMENT STANDARD

CORROSIVE AND REACTIVE MATERIALS

- a. Label materials if needed upon arrival on site.
 - b. Mark reactive materials containers with the date of receipt of the chemical.
3. Check incoming corrosive and reactive materials for materials safety data sheets. If MSDS are not already on file, order them from the manufacturer, distributor or vendor.
 4. Add incoming corrosive and reactive chemicals to the hazardous materials inventory - if not already on the inventory following procedures set forth in SMS 2, "Worker Right to Know".
 5. Do not store any quantity of corrosive or reactive materials except consumer products in an office. These materials are to be stored off-site or at an on-site laboratory or storage area.

D. Store corrosive and reactive materials appropriately.

1. Store corrosives and reactive materials as indicated on the Material Safety Data Sheet. In general, store these materials:
 - a. In a cool, dry environment, free from extremes of temperature and humidity.
 - b. In a manner that separates them from other materials (including flammables and oxidizers) and from each other.
 1. Separate acids and bases.
 2. Separate reactive materials from acids and bases, and protect from contact with water.
 - c. On materials that are acid resistant (Teflon-coated, plastic, etc.) for small containers.
 - d. Covered, not stacked on one another on acid resistant material - for carboys (approximately 5 gallons/22 liters) in the same manner as small containers.
 - e. On individual racks or securely blocked on skids with closure (plug) facing upward to prevent leakage for drums.

E. Require that labeling & signage are in place.

URS SAFETY MANAGEMENT STANDARD

CORROSIVE AND REACTIVE MATERIALS

Label containers with the appropriate warning word to indicate the hazard: DANGER; WARNING; CAUTION; CORROSIVE; OXIDIZER.

F. Use corrosive and reactive materials appropriately.

1. Safe-handling procedures will vary with each operation and type and concentration of the chemical, in all cases review the Material Safety Data Sheet and product information before use.
2. Use SMS 29 - Personal Protective Equipment when working with or around corrosive and reactive materials.
 - a. Review the MSDS for the chemical used to determine the type of PPE needed.
 - b. Wear the following PPE as a minimum when working with corrosives and reactive materials:
 1. Chemical splash goggles.
 2. Chemical resistant gloves.
 3. Chemical resistant apron.
3. Obtain medical care immediately in the event of:
 - a. Skin or eye exposure (e.g., splash) to corrosive liquids.
 - b. Inhalation of vapors of corrosive liquids that cause respiratory discomfort.
4. Require an eyewash to be located in all areas where acids or bases are used. Safety showers should be nearby if significant acid or base quantities are involved.
 - a. Place emergency eyewashes and showers in accessible locations that require no more than 10 seconds to reach and are in a travel distance no greater than 25 feet (7.5 meters) from the hazard.
 - b. Mark emergency eyewashes and showers with a highly visible sign.
 - c. Require the area around emergency eyewashes and showers to be well lighted and visible.

URS SAFETY MANAGEMENT STANDARD

CORROSIVE AND REACTIVE MATERIALS

- d. Require emergency showers to deliver a minimum 20 gallons (85 liters) per minute for 15 minutes.
- e. Require emergency eyewashes to be capable of delivering to the eyes not less than 1.5 liters per minute for 15 minutes.

G. Be prepared to clean up spills of corrosive and reactive materials.

- 1. Have a written spill response plan in place before materials are stored on site.
- 2. Have commercially-available spill kits available for clean up of small quantities of materials.
- 3. Clean up or respond to spills promptly.
- 4. Do not use combustible organic materials (sawdust, excelsior, wood chips and shavings, paper, rags or burlap bags) to absorb or clean up spills.

H. Dispose of corrosive and reactive materials appropriately.

- 1. Segregate organic acids, inorganic acids, and basic wastes.
- 2. Contract hazardous waste disposal services should be obtained to dispose of waste materials. All waste must be appropriately packaged for off-site transportation.

I. Inspect corrosive and reactive storage and use areas periodically.

- 1. Inspect office settings quarterly.
- 2. Inspect field related project sites at least once a week.
- 3. Use the inspection sheet provided as Attachment 9-1 to inspect sites.

5. Documentation Summary

A. File these records in the Office Safety Filing System:

- 1. Completed Corrosive and Reactive Material Inspection Sheets.
- 2. Worker Right to Know training documentation.

URS SAFETY MANAGEMENT STANDARD **CORROSIVE AND REACTIVE MATERIALS**

B. For field operations, file these records in the Project Safety File.

1. Completed Corrosive and Reactive Material Inspection Sheets.
2. Worker Right to Know training documentation.

6. Resources

- A. ANSI Z358.1-1990 American National Standard for Emergency Eyewash and Shower Equipment
- B. U.S. OSHA Technical Links - Personal Protective Equipment
- C. U.S. OSHA Technical Links - Hazard Communication
- D. Australian Standards AS 3780 - 1994. The Storage and Handling of Corrosive Substances
- E. Attachment 9-1 - Inspection Sheet

URS SAFETY MANAGEMENT STANDARD **Electrical Safety**

1. Applicability

This program applies to URS field operations in North American where electricity is used, electrical systems are installed or maintained, or where live electrical circuits are accessed. For work around overhead or underground utilities, see SMS 34, "Utility Clearances".

2. Purpose and Scope

This procedure describes requirements for working on electrical circuits with voltage greater than 50 volts. The primary hazards related to electricity are shock; burns; arc-blast; fire and explosions. This procedure is intended to reduce worker risk to electrical hazards.

3. Implementation

Office Locations - Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Any work performed on live electrical systems must be done by a licensed or journeyman electrician.

B. Follow established lockout/tagout procedures. Refer to SMS 23, "Lockout and Tagout Safety".

1. Consider all electrical systems as hot until verified de-energized and grounded.

2. Do not work on or in close proximity to electrical circuits unless the circuit is de-energized, grounded or guarded.

C. Hazardous Locations

Determine if electric equipment and wiring will be installed in locations that are classified depending on:

1. The properties of flammable vapors, liquids or gases, or combustible dusts or fibers that may be present; as well as the likelihood that a flammable or combustible concentration or quantity

URS SAFETY MANAGEMENT STANDARD

Electrical Safety

is present. (Refer to Attachment 12-1 for definitions of Hazardous Locations)

2. Consult Resources A, B, E, and F for information on working in classified locations.

D. Ground Fault Circuit Interrupters and Grounding

1. Ground Fault Circuit Interruptors

- a. Provide approved ground-fault circuit interrupters for all 120-volt, single phase, 15- and 20-ampere receptacle outlets on construction sites.
- b. Provide ground-fault circuit interrupters for all 120-volt, single phase, 15-and 20-ampere receptacle outlets within garages, bathrooms, kitchens and shops.

2. Grounding/Earthing

Effectively ground all wiring, electrical circuits, and equipment, except portable tools & appliances protected by an UL-approved system of double insulation. Examples of equipment requiring grounding include:

- a. Portable and vehicle or trailer mounted generators.
- b. Electrically powered arc welders.
- c. Switches.
- d. Motor controller cases.
- e. Fuse boxes.
- f. Distribution cabinets.
- g. Frames.
- h. Non-current-carrying rails used for travel and motors of electrically operated cranes.
- i. Electric elevators.

URS SAFETY MANAGEMENT STANDARD

Electrical Safety

- j. Metal frames of non-electric elevators to which electric conductors are attached.

E. Circuits

- 1. Require that there are no missing blanks.
- 2. Close doors to circuit and fuse boxes when not in use.
- 3. Label every circuit located on a circuit breaker/fuse box and/or motor control center (MCC).

F. Temporary Wiring, Electrical Tools and Extension Cords

- 1. Require that temporary wiring is installed and used in accordance with references. Specifically:
 - a. Guard, bury or isolate by elevation temporary wiring to prevent accidental contact by workers and equipment.
 - b. Require that vertical clearance above walkways is not less than 10 feet (3 metres) from circuits carrying 600 volts or less.
 - c. Support all exposed temporary wiring on insulators.
 - d. Protect temporary wiring from accidental damage.
 - e. Guard live parts of wiring.
 - f. Mark temporary power lines, switch boxes, receptacle boxes, metal cabinets and enclosures around equipment to indicate the maximum operating voltage.
- 2. Require that lighting strings are installed and used in accordance with Resources A and B. Specifically:
 - a. Use nonconductive lamp sockets and connections permanently molded to the conductor insulation.
 - b. Require that lighting strings have lamp guards.
 - c. Replace all broken or defective bulbs promptly.

URS SAFETY MANAGEMENT STANDARD

Electrical Safety

- d. Protect all lights used for illumination from accidental contact or breakage.
 - e. Ground metal-case sockets.
- 3. Require that extension cords are installed and used in accordance with Resources A and B. Specifically:
 - a. Use only 3-wire grounded type extension cords, designated for hard service or extra hard service and listed by Underwriters Laboratories, Inc.
 - b. Check cords for damage before use.
 - c. Do not exceed the rated load.
 - d. Do not use spliced cords.
 - e. Destroy and discard worn or frayed cords.
 - f. Do not fasten extension cords with staples, hang them by nails or suspend them by wire.
 - g. Do not wrap cords or cables around any conductive materials.
- 4. Require that portable electric tools brought onto the site are in good condition. Before use on any shift, visually inspect portable cord and plug connected equipment for external defects and evidence of possible internal damage.
- G. Report to supervision potential electrical hazards or unexpected occurrences while electrical renovation or construction occurs.
- H. Keep accurate records of all pertinent work performed on a project.
 - 1. Keep as-built designs updated.
 - 2. Share information on modifications with contractors on site.
- I. Isolation of live electrical components

Isolate all live, unprotected electrical components through the use of barricades, fencing or other means to protect employees from contact.

URS SAFETY MANAGEMENT STANDARD

Electrical Safety

J. Briefing

1. Brief workers on electrical hazards at the beginning of the job.
Utilize Attachment 12-2 as a guide for proper PPE as applicable.
2. Brief new workers entering the site.
3. Brief workers when electrical conditions change or when hazards exist.

K. Inspection

Inspect the job site periodically using Attachment 12-3 to evaluate compliance with this standard.

5. Documentation Summary

Project Safety Files

- A. Licensed/journeyman electrician for project (as necessary).
- B. Attachment 12-3, "Audits."
- C. Documented communications between URS, contractors, licensed/journeyman electricians, or others.

6. Resources

- A. U.S. OSHA Standard - General Industry Electrical Safety - 29 CFR 1910, Subpart S
- B. U.S. OSHA Standard - Construction Electrical Safety - 29 CFR 1926, Subpart K
- C. U.S. OSHA Standard - Design Safety Standards for Electrical Systems - 29 CFR 1910, Subpart S
- D. U.S. OSHA Standard - The Control of Hazardous Energy (Lockout/Tagout) - 29 CFR 1910.147
- E. Australian Standards SAA HB94-1997 - Electrical Safety in the Workplace
- F. American National Standards Institute. ANSI C-2.1996 National Electrical Safety Code

URS SAFETY MANAGEMENT STANDARD **Electrical Safety**

G. National Fire Protection Association, National Electric Code, NFPA-70

The following documents are PDF files requiring the use of Adobe Acrobat reader.

H. Attachment 12-1 - Hazardous Locations

I. Attachment 12-2 - PPE, Tools and Equipment

J. Attachment 12-3 - Electrical Hazard Check Sheet

URS SAFETY MANAGEMENT STANDARD

Excavation Safety

1. Applicability

This procedure applies to projects where URS controls trenching and excavation activities, and/or where URS employees are exposed to hazards associated with trenching and excavation activities.

2. Purpose and Scope

This procedure is intended to protect personnel from the hazards associated with excavation entry activities.

3. Implementation

Field Operations - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Competent Person

Appoint an Excavation Competent Person when URS controls excavation activities. The Excavation Competent Person:

1. Is responsible for conducting daily inspections of excavation, adjacent areas, and protective systems prior to each shift.
2. Is responsible for inspection after every rainstorm or other hazard.
3. Must have knowledge of soils and soil classification.
4. Understands design and use of protective systems.
5. Has authority to stop work and take corrective actions when conditions change.
6. Has the ability to recognize and test hazardous atmospheres.
7. Has formal documentation of training as an Excavation Competent Person.
8. Is physically located at the excavation while work is in progress.

B. Access/Egress

URS SAFETY MANAGEMENT STANDARD

Excavation Safety

1. Trench excavations will have ramps or ladders within 25 feet (8 meters) of the entrants.

C. Soil Classification

Soil classifications must be conducted in accordance with Attachment 13-1. For the purposes of this standard all soils will be classified by a person meeting the qualifications of a competent person as described in 29 CFR 1929 subpart P. The competent person shall consult with a Registered Professional Engineer in the event the soil classification requires additional technical expertise.

D. Protective Systems

Protect employees in excavations deeper than 4 feet (1.2 meters) by means of properly designed protective systems. All protective systems must comply with 29 CFR 1926 Subpart P Appendices B, D, and E.

1. Sloping and Benching

See Attachment 13-2

2. Timber Shoring for Trenches

Timber shoring for trenches must be designed and stamped by a Registered Professional Engineer in accordance with 29CFR Subpart P, Appendix C.

3. Aluminum Hydraulic Shoring for Trenches

Aluminum hydraulic shoring for trenches must be approved by a Registered Professional Engineer in accordance with 29CFR 1926 Subpart P, Appendix D.

4. Alternatives to Timber Shoring

Trench shields and boxes must be either premanufactured with listed load ratings or designed, stamped and constructed under the direction of a Registered Professional Engineer.

5. Protective systems designed to protect employees in excavations deeper than 20 feet (6.1 meters) must be designed and stamped by a Registered Professional Engineer.

URS SAFETY MANAGEMENT STANDARD

Excavation Safety

6. Excavations will be clearly identified and barricaded to keep unauthorized individuals out.

E. Permit Authorization and Inspections

1. Use the Excavation Authorization Form (Attachment 13-3) of this procedure that requires the following issues to be addressed:
 - a. Employee training/briefings.
 - b. Electrical safety.
 - c. Surface encumbrances.
 - d. Underground installations and utilities.
 - e. Protective systems.
 - f. Access and egress.
 - g. Exposure to vehicular traffic.
 - h. Exposure to falling loads.
 - i. Warning systems for mobile equipment.
 - j. Testing for hazardous atmospheres.
 - k. Emergency rescue equipment.
 - l. Protection from hazards associated with water accumulation.
 - m. Stability of adjacent structures.
 - n. Protection of employees from loose rock.
 - o. Inspections.
 - p. Fall protection.
2. Require daily inspections of excavations to be conducted by Competent Person using Attachment 13-4.

F. Training/Briefings

URS SAFETY MANAGEMENT STANDARD

Excavation Safety

Conduct daily safety briefings for all employees associated with excavation activities and document on Attachment 13-3. Discuss excavation hazards, protective measures, and work practices that will be applicable to the day's activities.

5. Documentation Summary

Records required for the Project Safety File:

- A. Competent person qualifications.
- B. Excavation Authorization Form.
- C. Daily Competent Person inspections.
- D. Daily worker briefing documentation.
- E. Daily inspection records.

6. Resources

- A. U.S. OSHA Standard - Excavations - 29 CFR 1926, Subpart P
 - 1. Appendix B, Sloping and Benching
 - 2. Appendix C, Timber Shoring
 - 3. Appendix D, Aluminum Hydraulic Shoring
- B. U.S. OSHA Technical Links - Trenching and Excavation

The following documents are PDF files requiring the use of Adobe Acrobat reader.

- C. US Army Corp of Engineers projects, the requirements of EM 385-1-1, Section 25 (PDF file)
- D. Attachment 13-1 - Soils Classification
- E. Attachment 13-2 - Simple Slopes
- F. Attachment 13-3 - Excavation Authorization Form
- G. Attachment 13-4 - Daily Excavation/Trench Inspection Form

URS SAFETY MANAGEMENT STANDARD

Fire Prevention

1. Applicability

This procedure applies URS office and project locations.

2. Purpose and Scope

The purpose of this procedure is to reduce/eliminate potential fire hazards in the workplace and to provide for a rapid, effective response should a fire occur.

3. Implementation

Office Locations – Implementation of this procedure is the responsibility of the Office Manager.

Field Activities – Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

General

- A. Develop an Emergency Action Plan as outlined in SMS 3, "Emergency Action Plans."
- B. Maintain good housekeeping to reduce fire hazards and to provide safe routes of egress should a fire occur.
- C. Provide the appropriate number and types of fire extinguishers for the operations being performed. Refer to Attachment 14-1 for guidance.
- D. Inspect fire extinguishers monthly and maintain an inspection log.
- E. Conduct frequent periodic inspections to identify fire hazards such as:
 - 1. Unnecessary accumulation of combustibles.
 - 2. Unnecessary storage of flammables.
 - 3. Sources of ignition (e.g., faulty wiring, sparks, open flame, etc.).
- F. Remove all fire hazards promptly.
- G. Prohibit smoking and other ignition sources in flammable storage and other fire hazard areas.

URS SAFETY MANAGEMENT STANDARD

Fire Prevention

- H. Post emergency numbers near telephones and evacuation maps in appropriate locations.
- I. Conduct evacuation drills.
- J. Train employees in:
 - 1. Fire hazard recognition.
 - 2. Fire hazard prevention.
 - 3. Fire extinguisher use.
 - 4. Emergency and evacuation procedures.

6. Documentation Summary

File the following in the Office/Project Health and Safety File:

- A. Emergency Action Plans.
- B. Fire extinguisher inspection logs.
- C. Employee training documentation.
- D. Site audits.
- E. Evacuation drills.

7. Resources

- A. U.S. OSHA Standard - Means of Egress - 29 CFR 1910, Subpart E
- B. U.S. OSHA Standard - Employee Emergency Plans and Fire Prevention Plans - 29 CFR 1910.38
- C. U.S. OSHA Standard - Fire Protection - 29 CFR 1910, Subpart L
- D. U.S. OSHA Technical Links - Fire Safety
- E. U.S. OSHA Construction Standard - Fire Protection and Prevention 29 CFR 1926, Subpart F
- F. U.K. - "Fire Precaution" Regulations

URS SAFETY MANAGEMENT STANDARD
Fire Prevention

- G. Australian Standards AS 1851.1-1995 - Maintenance of Fire Protection Equipment - Portable Fire Extinguishers and Blankets
- H. Australian Standards Collection 15 - Fire Extinguishing Equipment
- I. USACE EM 385-1-1 Section 9 - Fire Prevention and Protection
- J. Attachment 14-1 - Fire Extinguisher Placement Guidelines

URS SAFETY MANAGEMENT STANDARD

Flammable and Combustible Liquids and Gases

1. Applicability

This procedure applies to URS office and field operations where flammable and combustible liquids and gases are stored or used.

2. Purpose and Scope

The purpose of this procedure is to provide information regarding the proper storage, handling and work practices associated with flammable and combustible liquids and gases.

3. Implementation

Office Locations- Implementation of this program is the responsibility of the Office Manager.

Field Activities- Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Appoint a Responsible Person who will:

1. Inspect storage areas periodically.
2. Monitor the quantity of flammable and combustible liquids and gases on the site.
3. Review work practices.

B. Control flammables, combustibles, and flammable gases entering the site.

1. Order only those materials and quantities that are needed to complete a job.
2. Check compliance with SMS 2, "Worker Right to Know".

C. Storage

1. Store flammable and combustible materials in appropriate tanks and containers. See Attachment 15-1.
2. Limit building storage outside of a flammable storage cabinet or storage room per Attachment 15-1.

URS SAFETY MANAGEMENT STANDARD

Flammable and Combustible Liquids and Gases

3. Store oxidizers separately from flammables.
4. Segregate gas cylinders for storage based on their hazard (keep oxygen and acetylene cylinders stored separately).

D. Labeling and Signage

1. Post a "NO SMOKING OR OPEN FLAME" sign in all areas where flammable and combustible materials are stored, handled, and processed.
2. Require all containers and cylinders to be labeled with the contents and hazard-warning label.

E. Use of Materials on Site

1. Use flammable, combustible, and compressed gases in a manner that is consistent with the label and material safety data sheet for the product.
2. Use only those amounts of materials needed for the job. Transfer of flammables, combustibles, oxidizers to ready use containers is encouraged.
3. Use personal protective equipment stated on the product label and material safety data sheet.

F. Spill Control

1. Have a written spill response plan in place before materials are stored on site.
2. Clean up or respond to spills promptly.

G. Disposal

1. Keep solvent waste and flammable liquids in fire resistant, covered containers until they are removed from the worksite.
2. Do not place flammable or combustible waste in municipal garbage.
3. Dispose of flammable hazardous materials with a licensed hazardous material disposal company.

H. Inspection

URS SAFETY MANAGEMENT STANDARD

Flammable and Combustible Liquids and Gases

1. Periodically inspect flammable and combustible storage and use areas; gas storage areas and oxidizer storage areas:
 - a. Office settings inspect quarterly.
 - b. Field related projects, inspect once a month.
2. Use the inspection sheet provided as Attachment 15-2 to inspect the storage areas.

I. Training

Require that Hazard Communication training includes specific hazard information for the flammables, combustibles and oxidizers used.

5. Documentation Summary

- A. File these records in the Office Safety Filing System:
 1. Location of the MSDS inventory.
 2. Completed Flammable and Combustibles Inspection Checklist.
- B. File these records in the Project Safety Filing System:
 1. Attach program to Project Safety Action Plan.
 2. File these records in the Project Safety File.
 - a. Location of the MSDS inventory
 - b. Completed Flammable and Combustible Inspection Checklist.

6. Resources

- A. National Fire Protection Association - Standard 58
- B. Regulations of the U.S. Coast Guard
- C. U.S. OSHA Standard - Flammable and Combustible Liquids - 29 CFR 1910.106
- D. U.K. - "Highly Flammable Liquids" and "Liquid Petroleum Gases" Regulations

URS SAFETY MANAGEMENT STANDARD
Flammable and Combustible Liquids and Gases

- E. Australian Standards AS 1940-1993. The Storage and Handling of Flammable and Combustible Liquids
- F. Attachment 15-1 - Flammable and Combustible Liquid Classifications
- G. Attachment 15-2 - Flammable, Combustible, Oxidizer & Compressed Gas Inspection Sheet

URS SAFETY MANAGEMENT STANDARD

Hand Tools and Portable Equipment

1. Applicability

This procedure applies to URS operations involving the use of hand tools and/or power equipment, including chain saws, brush cutters, powder-actuated tools, and similar high-hazard implements.

2. Purpose and Scope

The purpose of this standard is to provide guidelines for the safe use and handling of hand tools and power equipment.

3. Implementation

Office/Facility Locations - Implementation of this program is the responsibility of the Office Manager.

Field Locations - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. General

1. Keep hand and power tools in good repair and used only for the task for which they were designed.
2. Remove damaged or defective tools from service.
3. Keep surfaces and handles clean and free of excess oil to prevent slipping.
4. Do not carry sharp tools in pockets.
5. Clean tools and return to the toolbox or storage area upon completion of a job.
6. Wrenches must have a good bite before pressure is applied.
 - a. Brace yourself by placing your body in the proper position so that in case the tool slips you will not fall.
 - b. Make sure hands and fingers have sufficient clearance in the event the tool slips.

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Hand Tools and Portable Equipment

- c. Always pull on a wrench, never push.
- 7. When working with tools overhead, place tools in a holding receptacle or secure when not in use.
- 8. Do not throw tools from place to place, from person to person, or drop from heights.
- 9. Use non-sparking tools in atmospheres with fire or explosive characteristics.
- 10. Inspect all tools prior to start-up or use to identify any defects.
- 11. Powered hand tools should not be capable of being locked in the on position.
- 12. Require that all power fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.
- 13. Do not allow loose clothing, long hair, loose jewelry, rings and chains to be worn while working with power tools.
- 14. Do not use cheater pipes.
- 15. Make provisions to prevent machines from automatically restarting upon restoration of power.

B. Grinding Tools

- 1. Inspect work rests and tongue guards for grinders.
 - a. Work rest gaps should not exceed 1/8 inch (3 mm).
 - b. Tongue guards gap should not exceed 1/4 inch (6 mm).
- 2. Do not adjust work or tool rests while the grinding wheel is moving.
- 3. Inspect the grinding wheel for cracks, chips or defects. Remove from service if any defects are found.
- 4. Wear goggles when grinding. A clear full face shield may be worn with the goggles.

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5. Do not use the side of a grinding wheel unless the wheel is designed for side grinding.
6. Always stand to the side of the blade, never directly behind it.
7. Use grinding wheels only at their rated speed.
8. Grinding aluminum is prohibited.
9. For U.K. operations:
 - a. No grinding wheels exceeding 55mm are to be used.
 - b. All wheels are to be marked with their safe maximum speed.
 - c. Abrasive wheels will only be operated by personnel who have been specifically trained and specified competent by URS.
 - d. Abrasive wheels will only be operated by persons specified as competent, under the 'Abrasive Wheels' Regulations.
 - e. Abrasive wheels must only be operated if the manufacturer's guard is fitted and they are in good working order.

C. Power Saws

1. Require that circular saws are fitted with blade guards.
2. Remove damaged, bent or cracked saw blades from service immediately.
3. Require that table saws are fitted with blade guards and a splitter to prevent the work from squeezing the blade and kicking back on the operator.
4. Require guards that cover the blade to the depth of the teeth on hand held circular saws. The guard should freely return to the fully closed position when withdrawn from the work surface.

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Hand Tools and Portable Equipment

D. Wood Working Machinery

1. Do not use compressed air to remove dust, chips and from wood working machinery.
2. Locate the on-off switch to prevent accidental start up. The operator must be able to shut off the machine without leaving the work station.
3. Guard planers and joiners to prevent contact with the blades.
4. Use a push stick when:
 - a. The cutting operation requires the hands of the operator to come close to the blade.
 - b. Small pieces are being machined.
5. Adjust saw blades so they only clear the top of the cut.
6. Automatic feed devices should be used whenever feasible.

E. Pneumatic Tools and Equipment

1. Require that pneumatic tools have:
 - a. Tool retainers to prevent the tool from being ejected from the barrel during use.
 - b. Safety clip or tie wire to secure connections between tool/hose/compressor if they are of the quick connection (Chicago fittings) type.
2. Do not lay hose in walkways, on ladder or in any manner that presents a tripping hazard.
3. Never use compressed air to blow dirt from hands, face or clothing.
4. Compressed air exhausted through a chip guarded nozzle shall be reduced to less than 30 psi. Proper respiratory, hand, eye and ear protection must be worn.
5. Never raise or lower a tool by the air hose.

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Hand Tools and Portable Equipment

F. Powder Actuated Fastener Tools

1. Use powder actuated tools that comply with the requirements of the American National Standards Institute (ANSI) standard A 10.3 - 1970.
2. Use only individuals that have been trained by a manufacturer's representative and possess the proper license to operate, repair, service and handle powder actuated tools.
3. Never use a powder actuated tool in a flammable or explosive atmosphere.
4. Require the use of goggles or a full face shield as well as safety glasses during operation of powder actuated tools.
5. Powder actuated tool must not be able to be fired unless the tool is pressed against the work surface.
6. The tool must not be able to fire if the tool is dropped when loaded.
7. Firing the tool should require two separate operations, with the firing movement being separate from the motion of bringing the tool to the firing position.
8. Never fire into soft substrate where there is potential for the fastener to penetrate and pass through, creating a flying projectile hazard.
9. Do not use powder actuated tools in reinforced concrete if there is the possibility of striking the re-bar.
10. Do not use on cast iron, glazed tile, surface hardened steel, glass block, live rock or face brick.
11. Never load and leave a powder actuated tool unattended. It should only be loaded prior to intended firing.
12. Test tools each day prior to loading by testing safety devices according to manufacturer's recommended procedure.

G. Chain Saws

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Hand Tools and Portable Equipment

1. Inspect the saw prior to each use and periodically during daily use.
2. Operate the chain saw with both hands at all times.
3. Never cut above chest height.
4. Require that the idle is correctly adjusted on the chain saw. The chain should not move when the saw is in the idle mode.
5. Start cutting only after a clear escape path has been made.
6. Shut the saw off when carrying through brush or on slippery surfaces. The saw may be carried no more than 50 feet (15 meters) while idling.
7. Require applicable protective gear. This may include, but is not limited to:
 - a. Loggers safety hat.
 - b. Safety glasses.
 - c. Steel-toed boots.
 - d. Protective leggings.
 - e. Hearing protection.
8. Inspect saws to require that they are fitted with an inertia break and hand guard.
9. Never operate a chain saw when fatigued.
10. Do not allow others in the area when chain saws are operated.
11. Make sure there are no nails, wire or other imbedded material that can cause flying particles.
12. Do not operate a chain saw that is damaged, improperly adjusted, or is not completely and securely assembled. Always keep the teeth sharp and the chain tight. Worn chains should immediately be replaced.

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Hand Tools and Portable Equipment

13. Keep all parts of your body away from the saw chain when engine is running.
14. For U.K. operations, only personnel specifically trained and certified as competent by URS can operate chain saws.

H. Hand Operated Pressure Equipment

1. Pressure equipment such as grease guns, paint and garden sprayers shall be directed away from the body and other personnel in the area. The person operating any equipment such as this, which has a potential for eye injury, must wear protective goggles.
2. The noise produced when using certain types of pressure equipment may require the use of hearing protection.
3. Never allow the nozzle of a pressurized tool to come in contact with any body parts while operating. There is potential for injection of a chemical directly into the user's body, resulting in severe injury or death.

I. Gasoline Powered Tools

1. Never pour gasoline on hot surfaces.
2. Never fuel around open flame or while smoking.
3. Shut down the engine before fueling.
4. Provide adequate ventilation when using in enclosed spaces.
5. Use only OSHA approved safety cans to transport flammable liquids.

J. Inspection

Inspect all hand tools on a regular basis. Defective tools shall be immediately removed from service, tagged or destroyed to prevent further use.

5. Documentation Summary

Place in the Project Safety File:

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Hand Tools and Portable Equipment

- A. Site briefings regarding tool use.
- B. Records of tools removed from service.
- C. Copies of powder actuated tool licenses (as applicable).
- D. Tool inspection documentation.

6. Resources

- A. U.S. OSHA Standard - Hand and Portable Power Tools - 29 CFR 1910, Subpart P
- B. U.S. OSHA Standard - Construction Tools - Hand and Power - 29 CFR 1926, Subpart I
- C. ANSI A10.3 – 1970
- D. National Association of Demolition Contractors
(<http://www.demolitionassociation.com/>)
- E. U.K. - 'Abrasive Wheel' Regulations
- F. U.K. - 'Wood-Working Machine' Regulations
- G. U.K. - 'Provision and Use of Work Equipment' Regulations
- H. Australian Standards Collection 26 - Occupational Health & Safety - Powered Machining and Tools

URS SAFETY MANAGEMENT STANDARD

Hazardous Waste Operations

1. Applicability

This standard applies to URS field operations involving the investigation or remediation of sites impacted with hazardous wastes or hazardous materials including those associated with underground storage tanks.

Investigation projects for real estate transactions conducted to confirm that a site is "clean" are not covered under this standard. Reference related Safety Management Standards for such operations.

2. Purpose and Scope

The purpose of this standard is to provide guidance designed to minimize hazardous chemical exposures to URS personnel while URS is conducting hazardous waste field operations.

Investigation techniques included under this standard include, but are not limited to, hand auger, soil gas evaluation, test pits, and all types of power drilling, including direct push. Remediation techniques included under this standard include, but are not limited to, excavation, groundwater treatment, soil gas treatment, containment, and landfarming and similar insitu methods.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager or Superintendent.

4. Requirements

A. Project Evaluation

Assess the technical and field aspects of every hazardous waste site project to evaluate:

1. Risk of exposure to hazardous chemicals, with particular attention to suspected or known human carcinogens.
2. Personal protective equipment requirements.
3. Air monitoring requirements.
4. Emergency services requirements.
5. Hazards addressed by other URS Safety Management Standards.

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6. Logistical considerations, such as access, distance from population centers.
7. Other safety and health hazards associated with site operations.

B. Client/Contract Evaluation

1. Review contract documents to determine whether the client has any special internal or regulatory requirements for hazardous waste site operations.
2. Implement client requirements in addition to those of this standard. Those requirements that are the most protective (e.g., most stringent) will be used.

C. Site-specific Health and Safety Plan

1. Prepare a site-specific Health and Safety Plan (HSP) for every project under this standard.
2. HSPs must be written or reviewed by a URS Health and Safety Regional Health and Safety Manager (RHSM) or a safety professional specifically approved by the RHSM.
3. Evaluate client and agency requirements prior to preparing the HSP, particularly if the client or an agency will approve the HSP prior to implementation.

D. Training

Verify that each assigned URS employee has completed required training. In general, the following are required for operations within North America:

1. 40-hours of initial training from an approved training provider.
2. 3-days of on-the-job training.
3. 8-hours of refresher training completed within 12 months of the initial or subsequent refresher training.
4. 8-hours of Site Safety Officer (Supervisor) training for directing the activities of any other URS employee.
5. Additional training for the Site Safety Officer as described below.

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Hazardous Waste Operations

E. Site Safety Officer

1. Appoint a Site Safety Officer (SSO) with appropriate qualifications for the specific hazardous waste project.
2. Assure that the SSO for complex projects, such as those with complicated remediation activities, has no duties other than site safety and health.
3. Verify that the SSO has completed basic supervisor training, and has additional required training and experience as applicable:
 - a. Advanced respiratory protection training is required for projects where supplied air respirators may be used.
 - b. Heavy equipment/construction safety.
 - c. Personal air monitoring.

F. Exposure Monitoring

Require that exposure monitoring is conducted in accordance with the HSP on all hazardous waste projects.

G. Project Equipment

1. Provide all health and safety equipment as described by the project Health and Safety Plan.
2. Provide all personal protective equipment as described by the project Health and Safety Plan.

H. Medical Surveillance

Verify that each URS employee assigned to the project meets the minimum requirements of the URS Medical Surveillance Program. This typically includes:

1. Baseline examination.
2. Annual examination.
3. Appropriate clearance for respirator use.

5. Documentation Summary

URS SAFETY MANAGEMENT STANDARD **Hazardous Waste Operations**

In the Project Safety File:

- A. Completed Health and Safety Plan.
- B. Completed and signed HSP approval form.
- C. Signed HSP acceptance form.
- D. Completed H&S field forms that are included in each HSP.
- E. Training and Medical Surveillance Clearance documentation for project personnel.

6. Resources

- A. U.S. OSHA Technical Links - Hazardous Waste Operations

The following documents are PDF files which must be read with Adobe Reader:

- B. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities - NIOSH 85-115
- C. USACE EM 385-1-1 - Hazardous, Toxic and Radioactive Waste

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Heat Stress

1. Applicability

This procedure applies to URS field projects where ambient (not adjusted) temperatures exceed 70°F (21°C) for personnel wearing chemical protective clothing, including Tyvek coveralls, and 90°F (32°C) for personnel wearing normal work clothes.

2. Purpose and Scope

The purpose of this procedure is to protect project personnel from the effects of heat related illnesses.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Monitor ambient temperatures and conduct Heat Stress Monitoring when threshold temperatures (see Section 1) are reached.

B. Conduct initial monitoring to determine first rest break.

1. Measure the air temperature with a standard thermometer with the bulb shielded from radiant heat; this yields T (actual).

2. Estimate the fraction of sunshine by judging what percent time the sun is not shielded by clouds that are thick enough to produce a shadow. 100 percent sunshine - no cloud cover = 1.0; 50 percent sunshine - 50 percent cloud cover = 0.5; 0 percent sunshine - full cloud cover = 0.0.

3. Plug these variables into the following equation to determine the adjusted temperature:

$$T \text{ (adjusted)} = T \text{ (actual)} + (13 \times \text{fraction sunshine})$$

4. Use Attachment 18-1 to determine the length of the first work shift. At the first break, initiate the heart rate monitoring or body temperature monitoring as described below.

C. Body Temperature Monitoring

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Heat Stress

1. Monitor oral body temperature to determine if employees are adequately dissipating heat buildup. Ear probe thermometers which are adjusted to oral temperature are convenient and the preferred method of measurement. Determine work/rest regimen as follows:
 - a. Measure (oral adjusted) temperature at the end of the work period.
 - b. If temperature exceeds 99.6 °F (37.5°C), shorten the following work period by 1/3 without changing the rest period.
 - c. If temperature still exceeds 99.6 °F (37.5°C), shorten the following work period by 1/3.
 - d. Do not allow a worker to wear impermeable PPE when his/her oral temperature exceeds 100.6 °F (38.1°C).

2. Oral temperatures are to be obtained prior to the employee drinking water or other fluids.

- D. Record monitoring results on Heat Stress Monitoring Form (Attachment 18-2).
- E. Investigate the use of auxiliary cooling devices in extreme heat conditions.
- F. Conduct briefings for employees regarding health hazards and control measures associated with heat stress whenever conditions require the implementation of heat stress monitoring. Review the information provided in Attachment 18-3.
- G. Provide water and electrolyte replacement drinks fluids as described in Attachment 18-3.
- H. Allow employees who are not accustomed to working in hot environments appropriate time for acclimatization (see Attachment 18-3).
- I. Provide break areas as described in Attachment 18-3.

5. Documentation Summary

File these records in the Project Safety File.

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Heat Stress

- A. Heat Stress Monitoring Forms.
- B. Employee Safety Briefing Verification Forms.

6. Resources

- A. NIOSH - "Working in Hot Environments"
- B. AFL-CIO Building Trades Division - "Heat Stress in Construction"
- C. Attachment 18-1 - Initial Work Monitoring Cycles
- D. Attachment 18-2 - Heat Stress Monitoring Record
- E. Attachment 18-3 - Informational Supplement

URS SAFETY MANAGEMENT STANDARD

Heavy Equipment Operations

1. Applicability

This procedure applies to URS field projects where heavy equipment is in operation.

2. Purpose and Scope

The purpose of this procedure is to require that heavy equipment is operated in a safe manner, that the equipment is properly maintained and that ground personnel are protected.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Authorized Operators

1. Evaluate operators through documentable experience (resume) and a practical evaluation of skills.
2. Allow only qualified operators to operate equipment.
3. Prohibit equipment from being operated by any personnel who have not been specifically authorized to operate it.
4. Maintain a list of operators for the project and the specific equipment that they are authorized to operate.
5. Require operators to use seat belts at all times in all equipment and trucks.
6. Brief operators on the following rules of operation:
 - a. Operators are in control of their work area.
 - b. Equipment will be operated in a safe manner and within the constraints of the manufacturer's Operation Manual.
 - c. Operators will stop work whenever unauthorized ground personnel or equipment enter their work area and only resume work when the area has been cleared.

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B. Ground Personnel

1. Require that ground personnel on the site have received training and comply with the following rules of engagement:
 - a. All ground personnel must wear orange protective vests when in work areas with any operating equipment.
 - b. Ground personnel will stay outside of the swing zone or work area of any operating equipment.
 - c. Ground personnel may only enter the swing or work area of any operating equipment when:
 1. They have attracted the operator's attention and made eye contact.
 2. The operator has idled the equipment down and grounded all extensions.
 3. The operator gives the ground personnel permission to approach.
 - d. Ground personnel shall never walk or position themselves between any fixed object and running equipment or between two running pieces of equipment.

C. Equipment

1. Maintain operations manuals at the site for each piece of equipment that is present on the site and in use.
2. Require that operators are familiar with the manual for the equipment and operate the equipment within the parameters of the manual.
3. Require that all equipment is provided with roll-over protection systems (ROPS). Tracked excavators are exempt from ROPS requirements but must have a cab which provides protection from overhead hazards
4. Verify that seatbelts are present and functional in all equipment.

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Heavy Equipment Operations

5. Prohibit the use of equipment which has cab glass which is cracked, broken or missing.
6. Require that backup alarms are functional on all trucks and equipment. Tracked excavators must have bidirectional alarms or the operator must be provided with a spotter whenever tracking in either direction.
7. Require all extensions such as buckets, blades, forks, etc. to be grounded when not in use.
8. Require brakes to be set and wheels chocked (when applicable) when not in use.

D. Inspection and Maintenance

1. Require daily inspections of equipment by operators using Attachment 19-1.
2. Prohibit use of equipment deemed to be unsafe as a result of daily inspection until required repairs or maintenance occur.
3. Conduct maintenance as prescribed by the manufacturer in the Operations Manuals for each piece of equipment.
4. During maintenance/repair, require that:
 - a. Motors are turned off.
 - b. All extensions are grounded or securely blocked.
 - c. Controls are in a neutral position.
 - d. Brakes are set.

5. Documentation Summary

File the following documents in the Project Health and Safety File.

- A. List of authorized operators.
- B. Operator qualifications.
- C. Daily Equipment Inspection Logs.

URS SAFETY MANAGEMENT STANDARD **Heavy Equipment Operations**

- D. Site Briefing documentation for operator rules and ground personnel "rules of engagement".

6. Resources

- A. U.S. OSHA Standard - Motorized Vehicles and Mechanized Equipment - 29 CFR 1926, Subpart O
- B. National Association of Demolition Contractors – Safety Manual (<http://www.demolitionassociation.com/>)
- C. Queensland Workplace Health and Safety - Competency Standard for Users & Operators of Industrial Equipment
- D. Attachment 19-1 - Equipment Inspection Form

URS SAFETY MANAGEMENT STANDARD

Noise and Hearing Conservation

1. Applicability

This procedure applies to URS Corporation facilities and field operations where URS Corporation personnel may encounter noise exposures that may exceed 85 dBA as an 8 hour Time Weighted Average.

2. Purpose and Scope

The purpose of this procedure is to protect employees from hazardous noise exposures and to prevent hearing loss.

3. Implementation

Office/Lab locations: High noise is unlikely to be encountered at URS offices, however, if applicable, the implementation of this program is the responsibility of the Office Manager.

Field Activities: Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. General

The use of hearing protectors in any location where powered or motorized equipment or any other noise source could reasonably be expected to exceed 85 dBA. Use of hearing protectors may only be discontinued when noise levels are verified to be less than 85 dBA through a properly conducted noise survey. Whenever information indicates that any employee's exposure may equal or exceed an 8-hour time-weighted average of 85 decibels, the project manager or location manager will be responsible to enforce the proper use of hearing protectors.

B. Hearing Protectors

1. Require that at least two (2) types of hearing protectors are available to employees free of charge, preferably a plug and a muff type.
2. Minimum Noise Reduction Ratings (NRR)

Hearing protectors issued must have the following minimum NRR:

Ear Plug	Muffs
29 dBA	27 dBA

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Noise and Hearing Conservation

3. Require that hearing protectors are used and thus effectively protect hearing.

C. Noise Surveys

1. Noise surveys must be conducted in a manner that reasonably reflects the exposure of the affected employees. Surveys must be conducted under the supervision of a URS Safety Program Representative.
2. Sound level meters and audio dosimeters used to determine employee exposure to noise sources must be Type II (accurate to within ± 2 dBA), operated in "slow" response, on the "A" scale, and be calibrated to factory guidelines (including periodic factory recalibration).

D. Noise Controls

Eliminate noise sources to the extent possible. Examples of controls that must be considered follow:

1. Addition or replacement of mufflers on motorized equipment.
2. Addition of mufflers to air exhausts on pneumatic equipment.
3. Following equipment maintenance procedures to lubricate dry bearings.
4. Isolation of loud equipment with newer and quieter models.

E. Audiometric Exams

1. Tests

Details on the medical surveillance program (including audiometric testing) are included in SMS 24.

Audiometric tests shall be performed by a person meeting OSHA's 1910.95 (g)(3)'s definition. Within 6 months of an employee's first exposure at or above the action level, a valid baseline audiogram shall be established against which subsequent audiograms can be compared. Testing to establish a baseline audiogram shall be preceded by 14 hours without exposure to noise. Hearing protectors may be used as a substitute for the requirement that

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Noise and Hearing Conservation

baseline audiogram shall be preceded by 14 hours without exposure to workplace noise. The medical surveillance provider shall notify employees of the need to avoid high levels of non-occupational noise exposure during the 14-hour period immediately preceding the audiometric examination. For multi-year projects, an annual audiogram shall be obtained for each employee exposed at or above an 8-hour time-weighted average of 85 decibels.

Each employee's annual audiogram shall be compared to that employee's baseline audiogram to determine if the audiogram is valid and if there is a standard threshold shift (STS). If the annual audiogram shows that an employee has suffered a standard threshold shift, the employer will obtain a retest within 30 days and consider the results in assessing an STS as the annual audiogram. The audiologist, otolaryngologist, or physician shall review problem audiograms and shall determine whether there is a need for further evaluation. If an STS has occurred, the medical surveillance provider will notify the employee within 21 days of the determination.

2. Standard Threshold Shifts

If an employee's test results show a confirmed STS, their hearing protection will be evaluated and refitted, and a medical evaluation may be required.

F. Training

Verify that each employee who must work in a noisy environment is current on the required Hearing Conservation Training. Training must include the following topics:

1. The effects of noise on hearing.
2. The purpose of hearing protectors.
3. The advantages and disadvantages of various types of hearing protectors.
4. The attenuation of various types of hearing protection.
5. The selection, fitting, care, and use of hearing protectors.
6. The purpose of audiometric testing.

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Noise and Hearing Conservation

7. An explanation of the audiometric testing procedure.

5. Documentation Summary

- A. File these records in the Office Safety Filing System:
 1. Noise surveys, when applicable.
 2. Training Records.
- B. File noise surveys, when applicable, in the Project Safety File:

6. Resources

- A. U.S. OSHA Standard – Occupational noise exposure – 29 CFR 1910.95
- B. U.S. OSHA Construction Standard – Occupational noise exposure – 29 CFR 1926.52
- C. U.S. OSHA Technical Links - Noise and Hearing Conservation
- D. American Industrial Hygiene Association: The Occupational Environment – Its Evaluation and Control, Chapter 20. Fairfax, VA: 1997
- E. National Hearing Conservation Association web site
- F. URS SMS 24 Medical Screening and Surveillance

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SAFETY MANAGEMENT STANDARD

Work Over Water

1. Applicability

This procedure applies to URS projects where personnel will work above or immediately adjacent to water where a drowning hazard exists. Refer to SMS 053, "Marine Safety and Boat Operations."

2. Purpose and Scope

This procedure is intended to protect employees from drowning while working above or adjacent to water.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Review the project in the planning phase to determine if any work will occur above or immediately adjacent to water where a drowning hazard exists. In general, a risk of drowning (ROD) is present when:

1. Employees perform work on or under bridges without constant protection from falling into the water, or
2. Working surfaces at riverbanks slope so steeply that an employee could slip or fall into the water when no portable protection (like roping off) is used.

NOTE: Employees working on or under bridges who are constantly protected by guardrail systems, nets, or body belt/harness systems are deemed to be adequately protected from the danger of drowning and are not required to wear life jackets or buoyant work vests.

B. If any activities pose a risk of drowning do the following during the activity:

1. Provide employees with an approved (USCG for U.S. operations) life jacket or buoyant work vest. Employees should inspect life jackets or work vests daily before use for defects. Do not use defective jackets or vests.
2. Post ring buoys with at least 90 feet (27 meters) of line next to the work area. If the work area is large, post extra buoys 200 feet (60 meters) or less from each other.

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Work Over Water

3. Provide at least one life saving skiff, immediately available at locations where employees are working over or adjacent to water. Require that the skiff is in the water and capable of being launched by one person and is equipped with both motor and oars.
4. Designate at least one employee on site to respond to water emergencies and operate the skiff at times when there are employees above water.
 - a. If the designated skiff operator is not within visual range of the water, provide him or her with a radio or provide some form of communication to inform them of an emergency.
 - b. Designated employee should be able to reach a victim in the water within three to four minutes.
5. Require that at least one employee trained in CPR and first aid is on site during work activities.

5. Documentation Summary

Records required in the Project Safety File:

Copy of the fall protection plan designed for work activities – (as necessary)

6. Resources

- A. U.S. OSHA Standard - Working Over or Near Water - 29 CFR 1926.106
- B. U.K. - (Health, Safety & Welfare) Regulations

URS

Safety Management Standard Personal Protective Equipment

1. Applicability

This program applies to URS Corporation laboratory and field operations where the use of Personal Protective equipment (PPE) is warranted. Refer to SMS 42, "Respiratory Protection", for respiratory hazards. Hearing Protection issues are additionally addressed in SMS 26, "Noise and Hearing Conservation."

2. Purpose and Scope

This procedure provides information on recognizing those conditions that require personal protective equipment as well as selecting personal protective equipment for hazardous activities.

3. Implementation

Shop/Lab Locations - Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

- A. Perform hazard assessments for those work activities that are likely to require the use of PPE.
 - 1. Use Attachment 29-1 to perform the assessment.
 - 2. Reevaluate completed hazard assessments when the job changes.
- B. Eliminate the hazards identified in Attachment 29-1, if possible, through engineering or administrative controls.
- C. Select PPE that will protect employees if hazards cannot be eliminated.
 - 1. See Attachment 29-1 for recommended PPE.
 - 2. Review Material Safety Data Sheets for chemicals used for PPE recommendations.
 - 3. If needed, consult with the URS Health and Safety Representative for assistance in selecting PPE.

URS Safety Management Standard **Personal Protective Equipment**

- D. Provide required PPE to employees free of charge (excluding in some instances components of standard work attire such as steel-toed boots), assuring that it fits properly giving them a choice if more than one type is available.
- E. Whenever a hazard is recognized, and PPE is required, the employees will be provided with the appropriate PPE. However, when a PPE is not required, and the employee selects to wear his or her own PPE, the project manager shall ensure that the employee is properly trained in the fitting, donning, doffing, cleaning, and maintenance of his or her employee owned equipment.
- F. Conduct and document employee training.
 - 1. Train all employees who are required to wear PPE.
 - 2. Require that training includes:
 - a. When PPE is necessary to be worn.
 - b. What PPE is necessary.
 - c. How to properly don, doff, adjust and wear PPE.
 - d. Limitations of PPE
 - e. Proper care, maintenance, useful life and disposal of PPE.
 - 3. Training must be conducted before PPE is assigned.
 - 4. Refresher training is needed when:
 - a. New types of PPE are assigned to the worker.
 - b. Worker cannot demonstrate competency in PPE use.
 - 5. Keep written records of the employees trained and type of training provided, including the date of training.
- G. Maintain Protective Equipment
 - 1. Check personal protective equipment for damage, cracks, and wear prior to each use. Replace or repair equipment not found in good condition.

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2. Wash off contaminated protective equipment with water and mild soap, if necessary, to prevent degradation of the equipment.
- H. Periodically inspect worksites where employees are using personal protective equipment, using Attachment 29-2.
 1. Field activities – inspect work sites at least monthly.
 2. Office locations – inspect work sites semi-annually.

5.0 Documentation Summary

- A. Records required in the Project Safety File:
 1. Completed Hazard Assessment Certification Forms (Attachment 29-1)
 2. Completed Personal Protective Equipment Inspection Sheet (Attachment 29-2)
 3. Documentation of employee training.
- B. Records required in the Laboratory Safety Filing System:
 1. Completed Hazard Assessment Certification Forms (Attachment 29-1)
 2. Completed Personal Protective Equipment Inspection Sheet (Attachment 29-2)
 3. Documentation of employee training.

6.0 Resources

- A. U.S. OSHA Standards - Personal Protective Equipment -29CFR 1910 Subpart I
(<http://www.osha-slc.gov/SLTC/lead/index.html>)
- B. U.S. OSHA Construction Standard - Personal Protective Equipment –29 CFR 1926 Subpart E
(http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1926_SUBPART_E.html)
- C. U.S. OSHA Technical Links - Personal Protective Equipment
(<http://www.osha-slc.gov/SLTC/personalprotectiveequipment/index.html>)

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- D. Australian Standards SAA HB9-1994 - Occupational Personal Protection
- E. American National Standards Institute, ANSI Z89.1-1986, Protective Headwear
(http://www.ansi.org/cat_top.html)
- F. American National Standards Institute, ANSI Z87.1 - 1989, Eye and Face Protection
(http://www.ansi.org/cat_top.html)
- G. American National Standards Institute, ANSI Z41.1 - 1991, Foot Protection
(http://www.ansi.org/cat_top.html)
- H. SMS 40 - Fall Protection
- I. Attachment 29-1 Hazard Assessment Form
- J. Attachment 29-2 PPE Inspection Form

URS SAFETY MANAGEMENT STANDARD

Sanitation

1. Applicability

This procedure applies to URS field operations.

2. Purpose and Scope

The purpose of this program is to provide employees on field assignments with appropriate personal hygiene facilities, including toilets, wash rooms and eating facilities, and to protect employees from unsanitary conditions.

3. Implementation

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Arrange for the installation of adequate toilet and wash facilities during the planning stage of field projects. Note: Mobile crews having transportation readily available to nearby toilet facilities need not be provided with facilities.

1. Provide job sites without sanitary sewer with one of the following:
 - a. Privies (where their use will not contaminate ground or surface water).
 - b. Chemical toilets.
 - c. Combustion toilets.
2. Provide toilets for employees of each sex at field sites according to the following ratio:

Number of Employees	Minimum # of water closets (1)
1 - 15	1
16 - 25	2
36 - 55	3
56 - 80	4
81 - 110	5
111 - 150	6
Over 150	(2)

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Footnote (1) where toilet facilities will not be used by women, urinals may be provided instead of the minimum specified.

Footnote (2) 1 additional fixture for each additional 40 employees

B. Provide a means for washing hands next to toilet areas.

C. Arrange for fresh potable water to be available.

1. Fixed Facilities

Require backflow prevention devices, testing and administrative controls to be used for all potable water supply branches.

2. Field Sites

a. Require an adequate supply of potable water to be available.

b. Water containers must be tightly closed and marked as to the contents. Containers must have a tap and be refilled daily.

D. Maintain existing toilet and wash facilities.

1. Maintain toilets and toilet area in good repair and in a clean and sanitary condition.

2. Provide paper towels and soap or other suitable sanitizing material for washing hands.

3. Locate hand-washing facilities next to or near toilets.

E. Maintain availability and cleanliness of drinking water.

1. Maintain backflow devices in a sanitary condition.

2. Water coolers and water dispensers are to be kept in a sanitary condition and filled only with potable water.

3. Provide fountain-type dispensers or one-use cups at each water dispenser.

F. Maintain lunchrooms in a clean condition.

1. Require microwave ovens to be used for food only.

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2. Require refrigerators that are designated for food storage to be used for food only.
3. Do not allow workers to eat or store foods in areas where toxic materials are handled or stored.
4. Periodically clean lunchrooms.

G. Manage waste generated on site.

1. Release sanitary sewage into sanitary sewer lines or to other proper disposal channels.
2. Do not discharge hazardous waste into the sanitary sewer or storm sewer system.
3. Collect garbage and trash daily.
 - a. Garbage containers located outside buildings should have lids and remained closed. Transport garbage offsite at least weekly.
 - b. At remote field sites where bears and similar wild animals are a hazard, remove garbage from the site daily (do not let garbage remain on site overnight).

H. Prevent pests and vermin from multiplying on site. Eliminate unsanitary conditions that propagate insects or vermin.

- I. Inspect work sites using checksheet provided as Attachment 30-1 for compliance at the beginning of the project and mid -project.

5. Documentation Summary

File completed inspection sheets in the Project Safety File.

6. Resources

- A. U.S. OSHA Construction Standard - Sanitation - 29 CFR 1926.51
(http://www.osha-slc.gov/OshStd_data/1926_0051.html)
- B. U.S. OSHA General Industry Standard - Sanitation - 29 CFR 1910.141
(http://www.osha-slc.gov/OshStd_data/1910_0141.html)

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- C. National Interim Primary Drinking Water Regulations 40 CFR 141
(http://www.access.gpo.gov/nara/cfr/waisidx_99/40cfr141_99.html)
- D. Attachment 30-1 - Sanitation Inspection Checksheet
- E. Queensland Workplace Health and Safety -
Code of Practice for Construction Project Amenities

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SAFETY MANAGEMENT STANDARD

Work Zone Traffic Control

1. Applicability

This procedure applies to URS field operations involving work performed on roads, highways, and similar areas where motor vehicles may be a hazard.

2. Purpose and Scope

This procedure is intended to protect personnel from the hazards associated with work performed on or next to highways and roads.

3. Implementation

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

- A. Review the project in the planning phase to determine if any work will be performed on or adjacent to any road that will disrupt normal traffic flow.
- B. Hire a qualified contractor or have an in house Competent Person devise a traffic control plan based on the work to be performed.
 - 1. Competent persons are those who are knowledgeable about the fundamental principles of temporary traffic control and the work activities to be performed.
 - 2. Traffic control plans will be designed to meet requirements as set in the Manual on Uniform Traffic Control Devices (MUTCD) (Resource A) as well as those rules set by state, county and cities in which work is performed.
 - 3. Require that the plan is commensurate with the complexity of the project.
- C. Submit the traffic control plan to the road authority for approval.
 - 1. Submissions will be made to the state department of transportation or highways if state or federal highways are impacted as well.
 - 2. Local county representatives.
 - 3. Local city representatives, if within city limits.

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Work Zone Traffic Control

4. For U.K. operations, submittal is to be made to County Council or local authority.
- D. Decide whether to have qualified in house personnel or contract personnel implement the traffic control plan in the field.
 1. Certified flaggers may set up work zones.

Flaggers must attend an eight-hour work zone traffic control course as taught by an ATSSA certified instructor (or equivalent).
 2. Obtain appropriate traffic control equipment as described in Resource A.
 3. For U.K. operations, all operative must be trained in accordance with 'New Road and Street Works' Act.
- E. Execute the traffic control plan developed for the job site. Require all personnel who work on/or adjacent to the roadway to wear bright orange, strong yellow-green or fluorescent versions of these colors of approved work zone clothing, including:
 1. Vests, at a minimum.
 2. Coveralls, if desired.
 3. Rainwear or other apparel as needed.
- B. Require a Competent Person who is certified as a Worksite Traffic Supervisor supervises flaggers at least once a day.
- C. Develop a plan for the periodic inspection and maintenance of the Traffic Control Zone utilizing Attachment 32-1.

5. Documentation Summary

Records required in the Project Safety File:

- A. Copies of traffic control plans used on site.
- B. Training certificates for URS flaggers and Competent Persons.
- C. Qualifications of contracted flaggers and Competent Persons.
- D. Inspection records.

URS SAFETY MANAGEMENT STANDARD **Work Zone Traffic Control**

6. Resources

- A. Part VI of the Manual on Uniform Traffic Control Devices (MUTCD)
(<http://www.ohs.fhwa.dot.gov/>)
- B. American Traffic Safety Services Association
(<http://www.atssa.com/>)
- C. ATTSA Flagger Train the Trainer Program
(<http://www.flagger.com/>)
- D. U.K. - Section 7, Road Traffic Act
- E. U.K. - 'New Road and Street Works' Act
- F. Australian Standards SAA HB81.1-.5 - Field Guide for Traffic Controls at Work on Roads
- G. Australian Standards AS1742 - Manual of Uniform Traffic Control Devices
- H. Australian Standards SAA HB69.13-1995. Guide to Traffic Engineering Practice - Pedestrian
- I. Attachment 32-1 - Traffic Control Inspection Checklist
- J. Queensland Workplace Health and Safety -
A Guide to Preparing Workplace Health and Safety Plans for
Worker Safety Within Road Reserves
(<http://www.detir.qld.gov.au/hs/guide/gde26.pdf>)

URS SAFETY MANAGEMENT STANDARD

Utility Clearances And Isolation

1. Applicability

This procedure applies to URS projects where personnel may encounter subsurface or overhead utilities.

2. Purpose and Scope

Many field activities are conducted near aboveground and underground utilities. The primary purpose of this Standard is to establish operating requirements that will permit employees to work safely in the vicinity of electrical, natural gas, fuel, water, and other utility systems and installations. The secondary purpose is to prevent economic damage to utility systems from operations associated with project-related activities.

The term "utility clearance" includes

- A. The positive locating of utility systems in or near the work area.
- B. A signed statement by an appropriate representative attesting to the location of underground utilities and/or the positive de-energizing (including lockout) and testing of electrical utilities.

Note that in some cases, utility representatives may deem it appropriate or necessary to use insulating blankets to isolate a power line; this is an acceptable alternative to positive de-energizing (only utility representatives can make the determination).

"Contact" with overhead power lines is considered to occur when equipment is closer to power lines than permitted by the criteria in the table in Section 4.0.C.2.b below. (see note for U.K. operations).

3. Implementation

Field Operations - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

- A. Time for Completion

Complete utility clearances prior to the start of any work in the area of the utility that could feasibly result in contact with or damage to that utility.

- B. Local Regulations

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Utility Clearances And Isolation

Research local codes and regulations regarding utility locating and isolation requirements. Utility companies and locating services are among the appropriate resources.

C. Overhead Power Lines

1. Proximity to Power Lines

No work is to be conducted within 50 feet (15 meters) of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet (15 meters) of overhead power lines without first making this determination.

2. Operations adjacent to overhead power lines are **PROHIBITED unless one of the following conditions is satisfied:**

- a. Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- b. The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked so that no part, including cables, can come within the minimum clearances shown in the table.

MINIMUM DISTANCES FROM POWERLINES	
Powerlines Nominal System kV	Minimum Required Distance
0-50	10 feet (3 meters)
51-100	12 feet (3.6 meters)
101-200	15 feet (4.6 meters)
201-300	20 feet (6.1 meters)
301-500	25 feet (7.6 meters)
501-750	35 feet (10.7 meters)
751-1000	45 feet (13.7 meters)

Note: for U.K. operations, the specific safe distance is determined by the utility company.

- c. The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine

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Utility Clearances And Isolation

the minimum safe operating distance; get this determination in writing with the utility representative's signature.

3. All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the Project Manager prior to the start of work.

D. Underground Utilities

1. Do not begin subsurface work (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted. The use of as-built drawings must be confirmed with additional geophysical or other survey.
2. Contact utility companies or the state/regional utility protection service at least two (2) working days prior to excavation activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation.
3. Obtain utility clearances for subsurface work on both public and private property. Clearances are to be in writing, signed by the party conducting the clearance.
4. Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
5. Do not conduct mechanical-assisted subsurface work (e.g., powered drill rig, mechanical excavator, etc.) within five (5) feet (1.5 meters) of a confirmed or suspected utility or other subsurface structure. Confirm minimum distances for mechanical-assisted subsurface work with the utility owner, as distances beyond this five foot minimum may be required.
6. Subsurface work within five feet (1.5 meters) of a confirmed or suspected utility or other subsurface structure must be done by hand (e.g., hand auger, shovel) to the point where the obstruction is visually located and exposed. Once the obstruction location is confirmed in this manner, mechanical-assisted work may commence.

URS SAFETY MANAGEMENT STANDARD

Utility Clearances And Isolation

7. Reference SMS 13, "Excavation Safety" for additional information regarding subsurface operations.

E. Training

Conduct a site briefing for site employees regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.

5. Documentation Summary

File these records in the Safety Filing System:

1. Documents requesting utility clearance.
2. Documents confirming utility clearance.
3. Training/briefing documentation of each isolation.

6. Resources

1. Utility Locating Services (typically under "Utility" in the Yellow Pages)
2. NIOSH Alert - Preventing Electrocutions from Contact Between Cranes and Power Lines
(<http://www.cdc.gov/niosh/crane.html>)
3. One Call Utility Locating List
(<http://www.underspace.com/refs/ocdir.htm>)
4. National Utility Locating Contractor's Association
(<http://www.underspace.com/nu/index.htm>)
5. U.K. - Health and Safety Executive GS6

URS SAFETY MANAGEMENT STANDARD

Respiratory Protection

1. Applicability

This program defines responsibilities and procedures and is applicable to URS operations that may require the use of respiratory protection including Immediately Dangerous to Life and Health (IDLH) and emergency conditions. This program also addresses the voluntary use of respirators.

2. Purpose and Scope

The purpose of this procedure is to protect those employees performing operations for which exposures can not be controlled by use of conventional engineering or administrative controls and prior to establishing a negative air exposure assessment, and to require that respiratory protective equipment is selected, used, maintained, and stored in accordance with acceptable practices.

3. Implementation

Laboratory/Office/Shop Locations - Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

Program Administration- URS Health and Safety Director is responsible for the development and annual review of this program.

URS Health and Safety Program Representatives are responsible to:

- Assist responsible employees in the implementation of the program.
- Assessing local compliance with the program.

4. Requirements

A. Determine if respirators are needed or going to be used for hazardous jobs before assigning that job to an employee.

1. If the determination is that a potential for respiratory hazards exists with any portion of that job activity then, complete Attachment 42-1.
2. Contact a URS Health and Safety Program Representative if any of the questions in Attachment 42-1 are checked "yes."

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Respiratory Protection

3. Follow instructions in Attachment 42-2 for employees who wish to voluntarily use dust masks.
 4. Follow all the requirements of this procedure for employees who wish to voluntarily use tight-fitting (e.g., air purifying) respirators.
 5. Required respirators will be paid for by URS and will be provided without cost to the employee.
- B. Select the proper respirator for the job.
1. For those jobs identified in Attachment 42-1, contact a URS Health and Safety Program Representative for assistance in respirator selection.
 2. Contact a URS Health and Safety Program Representative for follow up if there are any problems implementing the recommendations made.
- C. Require employees who will use respirators to be medically qualified before fit testing and assigning them a respirator.
1. For program details, refer to SMS 24, Medical Screening and Surveillance.
 2. Require that employees have a current and accurate Medical Surveillance form (Attachment 24-2)
 3. Obtain a copy of the employee's Health Status Medical Report from the Health and Safety Representative. The consulting occupational physician of the medical service provider following each work related examination issues the Health Status Medical Report. Employees cannot be assigned respirators unless they are medically cleared for respirator use.
- D. Require respirator users to receive appropriate training.
1. All respirator users must be trained:
 - a. Before they are assigned a respirator.
 - b. Annually thereafter.
 - c. Whenever a new hazard or job is introduced.

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Respiratory Protection

- d. Whenever employees fail to demonstrate proper use or knowledge.
- 2. Training must address, at a minimum, the following:
 - a. Why the respirator is necessary, and what conditions can make the respirator ineffective.
 - b. What the limitations and capabilities of the respirators are.
 - c. How to use respirators effectively in emergency situations.
 - d. How to inspect, put on and remove, and check the seals of the respirator.
 - e. What the respirator maintenance and storage procedures are.
 - f. How to recognize medical signs and symptoms that may limit or prevent effective use of the respirator.
- E. Require respirator users to be fit tested.
 - 1. Any employee who has been assigned a reusable respirator must be fit tested on an annual basis (no more than one year may elapse between fit tests), or when the employee is assigned a respirator of a different make, type or size from that previously tested.
 - 2. Fit testing can be performed by contract or in house personnel.
 - 3. Obtain a signed written copy of the fit test results. The fit test results should include:
 - a. Employee's name and social security number.
 - b. Respirator brand, model and size fitted for.
 - c. Date fit tested.
 - d. Method of fit testing used.
 - e. Name and signature of fit tester.
 - f. Statement that fit test protocol met the requirements of 29 CFR 1910.134.

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- g. Manufacturer and serial number of fit testing apparatus.

A fit test results form is available at Attachment 42-5.

- F. Provide qualified employees with respirator(s) and adequate amounts of parts and cartridges.

- 1. Assign employees whose duties require respirators their own respirator for which they have been fit tested.
- 2. Provide special eyeglass inserts designed for the respirator if an employee must wear eyeglasses with a full facepiece respirator. Contact lenses may be worn when wearing a full facepiece respirator.

- G. Require respirators to be used properly.

- 1. Prohibit facial hair where the respirator-sealing surface meets the wearer's face.
- 2. Require employees to perform a positive and negative fit check every time the respirator is put on.
- 3. Employees will leave the area where respirators are being used:
 - a. Before removing the facepiece for any reason.
 - b. To change cartridges.
 - c. If any of the following is detected:
 - 1. Vapor or gas breakthrough.
 - 2. Leakage around the facepiece.
 - 3. Changes in breathing resistance.
- 4. Use cartridges with End of Service Life Indicators or determine the respirator cartridge changeout schedule. See Attachment 42-4 for Guidance.

- H. Require respirators to be cleaned and stored properly.

- 1. Clean and disinfect respirators after each use.

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2. Store respirators in a plastic bag or case and in a clean location.
3. Inspect respirators before use and after each cleaning.
- I. Address issues associated with special use respirators self-contained breathing apparatus; air supply respirators; emergency use respirators).

1. Self Contained Breathing Apparatus

Inspect self-contained breathing apparatus and other emergency use respirators monthly and after each use in accordance with manufacturer's instructions.

2. Air Supplied Respirators

- a. Air used for atmosphere-supplying respirators must meet or exceed the requirements for Type 1 - Grade D breathing air. Never use oxygen.

1. A certificate of analysis must accompany bottled air.

2. Compressors used to supply breathing air must:

- i. Prevent entry of contaminated air into the air supply.
 - ii. Minimize moisture content.
 - iii. Have suitable in-line sorbent beds and filter to provide appropriate air quality.
 - iv. Have a high carbon monoxide alarm that sounds at 10 ppm.

- b. Couplings on air hose lines must be incompatible with other gas systems.

- J. Require follow up training and medical surveillance to be provided as directed.

1. Provide follow-up physical examinations as directed by the SMS 24-3, Medical Screening and Surveillance Exam Protocol table.
 2. Provide follow-up physicals as directed by the Regional Medical Surveillance Administrator.

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3. Provide annual refresher training.
4. Provide annual fit testing.

5. Documentation Summary

A. Laboratory

1. File these records in the Laboratory Safety Filing System
 - a. Completed forms:
 1. "Identifying When A Respirator Is Needed" - Attachment 42-1; and,
 2. "Respirator Standard Operating Procedure" - Attachment 42-3.;
 - b. Employee Health Status Medical Report includes clearance for respirator use.
 - c. Employee Fit Test Records; and,
 - d. Employee Respirator Training Records.
2. Send a copy of the following records to the Regional Health and Safety Manager:
 - a. Completed "Voluntary Use of Respirators" form - Attachment 42-2.
 - b. Employee Fit Test Records.
 - c. Employee Respirator Training Records.

B. Field

1. File these records in the Project Health and Safety File:
 - a. Completed forms:
 1. "Identifying When A Respirator Is Needed" - Attachment 42-1; and,

URS SAFETY MANAGEMENT STANDARD **Respiratory Protection**

2. "Respirator Standard Operating Procedure" - Attachment 42-3.
 3. Employee Health Status Medical Report includes clearance for respirator use.;
 4. Employee Fit Test Records; and,
 5. Employee Respirator Training Records.
2. Send a copy of the following records to the Regional Health and Safety Manager:
- a. Completed "Voluntary Use of Respirators" form - Attachment 42-2;.
 - b. Employee Fit Test Records; and,
 - c. Employee Respirator Training Records.

6. Resources

- A. U.S. OSHA Standard - Respiratory Protection - 29 CFR 1910.134
 - B. U.S OSHA Technical Links - Respiratory Protection
 - C. ANSI Z88.6, Respirator Use – Physical Qualifications for Personnel, Current Revision
 - D. ANSI Z88.2, Respiratory Protection, Current Revision
 - E. 3M Cartridge Service Life Interactive Program
 - F. Australian Standards AS/N25 1715 - 1994. Selection, Use, and Maintenance of Respiratory Protection Devices
 - G. Australian Standards HB9-1994. Occupational Personal Protection
 - H. AIHA, The Occupational Environment - Its Evaluation and Control
- The following documents are PDF files which must be read with Adobe Reader:
- I. NIOSH Respirator Decision Logic

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- J. NIOSH Guide to Industrial Respiratory Protection
- K. Attachment 42-1 - Identifying When a Respirator is Needed
- L. Attachment 42-2 - Voluntary Use of Respirators
- M. Attachment 42-3 - Respirator Standard Operating Procedure
- N. Attachment 42-4 - Respiratory Cartridge Change Schedule
- O. Attachment 42-5 - Fit Test Results Form
- P. Medical Screening and Surveillance Program - SMS 24

URS SAFETY MANAGEMENT STANDARD

Personal Monitoring (Industrial Hygiene)

1. Applicability

This standard applies to URS operations where employees may be exposed to unacceptable concentrations of hazardous air contaminants.

2. Purpose and Scope

This standard is intended to assist and provide guidance to URS personnel that need to conduct personal industrial hygiene monitoring

Personal monitoring is to be conducted under the following conditions:

- A. Where directed by a site-specific health and safety plan.
- B. Where employees are exposed to known or suspected human carcinogens.
- C. Where regulations require "initial exposure assessments." The only exception to conducting an "initial exposure assessment" where there is a regulatory requirement to do so is when similar exposure assessments have been conducted under similar site conditions within one year prior to the start of work on the current project.

Retain a copy of the referenced initial exposure assessment and place it in the Project Safety File.

2. Implementation

Laboratory Locations - Implementation of this standard is the responsibility of the Laboratory Manager.

Field Activities - Implementation of this standard is the responsibility of the Project Manager.

3. Requirements

A. Procedures for Personal Industrial Hygiene Monitoring

- 1. Collect samples using the applicable methodologies established by either NIOSH or OSHA. Require the selected laboratory to utilize the applicable analytical methodologies.

URS SAFETY MANAGEMENT STANDARD

Personal Monitoring (Industrial Hygiene)

2. Document personal monitoring activities using a URS Industrial Hygiene Monitoring Form (Attachment 43-1) and require that all Chain of Custody forms are properly completed.

B. Evaluation of Personal Monitoring Results

1. Require that the analytical results be evaluated by a URS Health and Safety Program Representative.
2. Obtain a written evaluation report from the URS Health and Safety Program Representative. If exposures exceed the Action Level and/or Permissible Exposure Limit for the air contaminant(s) of concern, a verbal report is to be made to the Project Manager immediately, and the evaluation report will include required corrective actions.
3. Evaluation reports are to be completed within five working days of the receipt of the analytical results.

C. Communication of Sample Results and Evaluation

1. Provide copies of the evaluation report to the employee(s) monitored and to employees working in the area for whom the exposures could be representative.
2. Provide a copy of the evaluation report and monitoring data to the Medical Surveillance Administrator.

D. Corrective Actions

Implement required corrective actions immediately.

4. Documentation Summary

Maintain in the Project Safety File:

- A. Calibration data
- B. Completed IH Monitoring Form(s)
- C. Evaluation Report with sample results
- D. Relevant prior initial exposure assessments
- E. Provide to affected employees:

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- Evaluation Report with sample results

F. Provide to the Medical Surveillance Administrator:

- Evaluation Report with sample results
- List of employees affected by the sampling

5. Resources

- A. OSHA Analytical Methods
- B. OSHA Chemical Sampling Information
- C. American Industrial Hygiene Association, The Occupational Environment, Its Evaluation and Control.
- D. American Conference of Governmental Industrial Hygienists. Air Sampling Instruments for Evaluation of Atmospheric Contaminants.
- E. U.K. - 'Control of Substances Hazardous to Health'
- F. NIOSH Analytical Methods
- G. Attachment 43-1 - IH Monitoring Form

URS SAFETY MANAGEMENT STANDARD

Back Injury Prevention

1. Applicability

This procedure applies to URS operations where personnel perform manual lifting.

2. Purpose and Scope

The purpose of this procedure is to prevent back injuries to URS personnel.

3. Implementation

Office Locations - Implementation of this procedure is the responsibility of the Office Manager.

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Safe Lifting Practices in the Office

1. Require that personnel receive the training described in (C) below.
2. Evaluate all assignments that involve lifting, such as moving boxes of files and paper, computer equipment, and the like to see that the task can be completed without risk of back injury to assigned personnel.
3. Provide material handling devices, such as carts and dollies, to assist in the safe moving of materials.
4. Obtain outside assistance, such as contract movers, if the job cannot be safely accomplished by URS personnel.
5. Require that heavier items are stored on lower shelving units.

B. Safe Lifting Practices in the Field

1. Recognize that field assignments tend to be lifting-intensive, and that URS has a duty to provide the means by which personnel can perform lifting duties without risk of injury.
2. Require that personnel receive the training described in (C) below.

URS SAFETY MANAGEMENT STANDARD

Back Injury Prevention

3. Evaluate all field assignments that involve lifting to see that the tasks can be completed without risk of back injury to assigned personnel.
4. Provide material handling devices, such as carts, dollies, trucks with lift gates, to assist in the safe moving of materials. If required, assign additional personnel to the task.
5. Direct field personnel not to assist in lifting tasks that are normally undertaken by subcontractor personnel.
6. Contact a URS Health and Safety Program Representative when assistance is necessary to evaluate a lifting task that may pose a back injury risk to assigned personnel.

C. Training

1. Require that personnel who may have lifting as part of their duties receive training that includes the following topics:
 - a. Showing personnel how to avoid unnecessary physical stress and strain.
 - b. Teaching personnel to become aware of what they can comfortably handle without undue strain.
 - c. Instructing personnel on the proper use of equipment.
 - d. Teaching personnel to recognize potential hazards and how to prevent or correct them.
2. This training must be completed prior to an employee being assigned to a task that involves lifting.

D. Office Moves and Relocations

1. Utilize professional movers (who are appropriately insured) to move office furniture such as desks, file cabinets, and bookcases, even if such a move is only between offices or cubicles at a particular location (on-site move).
2. Utilize professional movers for intensive moving of file boxes and other heavy materials.

URS SAFETY MANAGEMENT STANDARD **Back Injury Prevention**

E. Material Packaging

1. Use only smaller size (<18") file ("Banker") boxes for file storage, as the larger (>18") boxes are awkward and readily overloaded.
2. Use only smaller coolers for field samples, as the larger coolers are awkward and readily overloaded.

5. Documentation Summary

File the following documents in the Office Health and Safety File

- Training rosters

File the following documents in the Project Health and Safety File

- Training rosters

6. Resources

- A. Work Practices Guide for Manual Lifting, NIOSH

URS SAFETY MANAGEMENT STANDARD

Subcontractor Health and Safety Requirements

1. Applicability

This procedure is applicable to subcontractors retained by URS to perform construction (including drilling and excavation), alteration, demolition, and/or repair activities utilizing their own workforce or equipment. This procedure is applicable to the operations of subcontractors and sub-subcontractors of any tier.

This procedure does not apply to third party contractor operations where there is no subcontract relationship between the contractor and URS Corporation. Health and safety issues regarding third party contractor operations are governed by project specific contracts and are not covered by this standard.

2. Purpose and Scope

This procedure provides guidelines on the pre-evaluation of subcontractor safety programs. It also provides guidance on contractual risk management, subcontractor safety performance on the job site, and the responsibilities of the Project Manager with respect to subcontractor jobsite safety performance.

It is recommended that each URS Corporation subcontractor be evaluated at least annually using Attachment 46-1, "Subcontractor Safety Evaluation Form," in order to perform work on any new URS Corporation projects.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Guidelines

A. Pre qualification of Subcontractor - The Project Manager shall complete the following procedures for all subcontractors retained on projects covered by this standard (the PM should also require subcontractors to follow these procedures with respect to pre-qualification of sub-subcontractors of any tier):

1. Request all subcontractor candidates to complete the attached "Subcontractor Health and Safety Evaluation Form" (Attachment 46-1).
2. Conduct an assessment of each subcontractor's qualifications with respect to the subcontractor health and safety evaluation criteria contained in Attachment 46-2.

URS SAFETY MANAGEMENT STANDARD

Subcontractor Health and Safety Requirements

3. Verify that subcontractors meet the insurance requirements as stated in Attachment 46-2 or as approved by Counsel.
4. If the subcontractor has been successfully evaluated within the last 12 months, that evaluation may be substituted.
5. For long term projects, this evaluation should be updated within 12 months of the previous evaluation.

B. Contractual and Risk Management Requirements of Subcontractors

1. Ensure that subcontractor is contractually bound to comply with applicable client and URS Corporation Health and Safety Program requirements.
2. Ensure that subcontractor is contractually bound to develop additional safety procedures for work that is exclusive to their activities on the site and for which they may have superior knowledge.
3. Assess compliance of subcontractor's insurance with the URS Corporation subcontract requirements (including, but not limited to, necessary types and amounts of coverage, URS Corporation additional insured endorsement, etc.).
4. Ensure that URS Corporation has the right in its subcontract, without liability to the subcontractor, to stop the subcontractor's work in the event of any violations of the applicable Health & Safety Plan.

C. Subcontractor Safety Representative

1. Require each subcontractor to appoint a Subcontractor Safety Representative (SSR) who:
 - a. Is knowledgeable of the subcontractor's activities.
 - b. Understands the safety requirements of the subcontractor's activities.
 - c. Has the ability to recognize and the authority to correct safety deficiencies and execute a stop work order should an imminent danger arise.

URS SAFETY MANAGEMENT STANDARD

Subcontractor Health and Safety Requirements

- d. Has the responsibility for the administration of the subcontractor Health and Safety Program.
- e. Will serve as the direct contact with URS Corporation regarding resolution of Health and Safety issues.

D. Communication

1. Provide the SSR with information regarding Site Safety Program including but not limited to:
 - a. Client Requirements.
 - b. URS Corporation Site Safety Program.
 - c. Site Hazard Communication Program.
 - d. Site Emergency Action Plan.
 - e. Any additional safety information from other contractors or subcontractors working on the site.
2. Provide SSR with name of URS Corporation project contact and alternate for addressing site Health and Safety issues.
3. Require the participation of subcontractors in all Site Safety Briefings.
4. Require subcontractor compliance with all safety directives and/or stop work orders issued by the URS Corporation site representatives.

E. Subcontractor Safety Performance

1. To the extent reasonable in light of URS Corporation's scope of work under the client contract, visit the site and periodically observe subcontractors operations (i.e., conduct spot checks) to assess whether subcontractor appears to be conducting its operations in accordance with applicable health and safety requirements. Periodically review any required subcontractor health and safety written documentation for compliance with applicable requirements.
2. In the event that deficiencies are observed immediately bring them to the attention of the SSR for resolution.

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Subcontractor Health and Safety Requirements

3. In the event of observation of an "Imminent Danger" situation (i.e. involving a situation that could result serious injury or death), immediately contact the SSR and stop the work.
4. Investigate all injuries/illnesses related to subcontractor operations to identify causes and effect corrective actions.
5. In the event of serious and/or continuing subcontractor breaches of applicable health and safety requirements contact legal counsel to assess whether formal contractual action is appropriate under the subcontract.

5. Documentation Summary

A. File in the Project Safety File

1. Subcontractor Health and Safety Evaluation Form.
2. Applicable and current Insurance Certificates.
3. Names and telephone numbers of SSR for each subcontractor.
4. Verification of Health and Safety documents transmitted to subcontractors and received from subcontractors.
5. Identified safety deficiencies as applicable for subcontractors and verification of correction of conditions.
6. All other safety related documentation between URS Corporation and subcontractor such as training certifications, etc.
7. Subcontractor safety plan, incident reports and resolution reports.

6. Resources

- A. Federal OSHA Workplace Injury and Illness statistics (<http://www.osha.gov/oshstats/work.html>)
- B. Managing Subcontractor Safety, Prepared by The Construction Industry Institute, Safety Task Force, Publication 13-1, The University of Texas at Austin, Austin, Texas, 1991 (<http://www.construction-institute.org/>)
- C. American National Standard Construction and Demolition Operations -- Safety and Health Program Requirements for Multi-Employer Projects,

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Subcontractor Health and Safety Requirements

ANSI A10.33-1992, National Safety Council, Itasca, Illinois 60143-3201
(<http://www.nsc.org>)

- D. "Liability, OSHA and the Safety of Outside Contractors," Professional Safety, American Society of Safety Engineers, January 1993
(<http://www.asse.org>)
- E. "Proactive Construction Management; Dealing With the Problem of Subcontractor Safety," Professional Safety, American Society of Safety Engineers, January 1990 (<http://www.asse.org>)
- F. "Design Professional Liability Under OSHA," Presented by Thomas F. Holt, Jr., HWAC Lawyer's Roundtable, June 14, 1995 (to be Published)
(<http://www.hwac.org>)
- G. "Occupational Injury and Illness Rates by SIC", Bureau of Labor Statistics, U. S. Department of Labor (<http://stats.bls.gov/sahome.html>)
- H. Attachment 46-1 - Subcontractor Safety Evaluation Form
- I. Attachment 46-2 - Subcontractor Evaluation Criteria

URS SAFETY MANAGEMENT STANDARD

Biological Hazards

1. Applicability

This program applies to job activities performed primarily in outdoor environments.

2. Purpose and Scope

The primary goal of this program is to eliminate or reduce illnesses and injuries transmitted by plants, insects, and animals. Although there are many animals and insects that are potentially harmful to humans (i.e. bees, spiders, bears, and rodents), this safety management standard focuses on four common biological hazards: ticks, poison plants, mosquitoes, and snakes.

3. Implementation

The Project Manager, with support from the URS H&S Regional Managers and Occupational Health Specialist, will be responsible for implementation of this program.

4. Requirements

A. Ticks

1. Precautionary Measures

Background information: Ticks do not jump, crawl, or fall onto a person. They are picked up when clothing or hair brushes a leaf or other object the tick is on. Ticks are generally found within three feet of the ground. Once picked up, they will crawl until they find a likely site to feed. Often they will find a spot at the back of the knee, near the hairline, behind the ears, or at pressure points where clothing presses against the skin (underwear elastic, belts, neckline). The best way to prevent tick borne diseases is not to be bitten by a tick. Ticks can carry a number of diseases including:

- Lyme Disease is an infection caused by the corkscrew-shaped bacteria *Borrelia burgdorferi* that is transmitted by the bite of deer tick (ixodes) and western black-legged ticks. The disease occurs in the forested areas of North America, Europe, and Asia. Symptoms which occur 3-30 days following a tick bite include: a spreading 'bulls-eye' rash, fever, fatigue, headache, and joint and muscle aches. Prompt treatment with antibiotics is essential in order to prevent more serious complications that may occur if left untreated.

URS SAFETY MANAGEMENT STANDARD **Biological Hazards**

- Rocky Mountain Spotted Fever is an infection caused by the bacteria *Rickettsia rickettsii*. The disease occurs in North, Central, and South America. Other *Rickettsia* organisms cause disease worldwide (Mediterranean, Japan, Africa, North Asia). Symptoms which occur 2-6 days following a tick bite include: fever, nausea, vomiting, diarrhea, rash, muscle and joint pain. The disease is treated with antibiotics.
- Babesiosis is caused by hemoprotezoan parasites of the genus *Babesia*. It is transmitted by the ixodid tick. The geographic distribution is worldwide. Symptoms include fever, chills, fatigue, muscle aches, and an enlarged spleen and liver. The disease is treated with anti-protozoan drugs.
- Ehrlichiosis is caused by several bacteria of the genus *Ehrlichiae*. The geographic distribution is global, primarily in temperate regions. Symptoms which occur 5-10 days following a tick bite include fever, headache, fatigue, muscle aches, nausea, vomiting, diarrhea, confusion, and occasionally a rash. The disease is treated with antibiotics.

a. Avoidance of tick habitats

Whenever possible, persons should avoid entering areas that are likely to be infested with ticks, particularly in spring and summer when nymphal ticks feed. Ticks favor a moist, shaded environment, especially that provided by leaf litter and low-lying vegetation in wooded, brushy, or overgrown grassy habitat. Both deer and rodent hosts must be abundant to maintain the life cycle of the tick.

b. Personal Protective Equipment

1. Wear light colored clothing or white Tyvek® to allow you to see ticks that are crawling on your clothing.
2. Tuck your pant legs into your socks or boots, wear high rubber boots, or use tape to close the opening where they meet so that ticks cannot crawl up the inside of your pant legs.
3. Wear a hat, tie back long hair.
4. Apply repellents to discourage tick attachment. Repellents containing permethrin can be sprayed on boots and clothing and will last for several days. Repellents containing DEET (n,n-diethyl-

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m-toluamide) can be applied to the skin, but will last only a few hours before reapplication is necessary. Apply according to Environmental Protection Agency guidelines to reduce the possibility of toxicity.

c. Tick Check

1. Change clothes when you return from an area where ticks may be located.
2. Shower to wash off any loose ticks.
3. Check your entire body for ticks. Use a hand held or full-length mirror to view all parts of your body.
4. Place clothing worn in tick infested areas into the dryer for at least 30 minutes in order to kill any ticks.

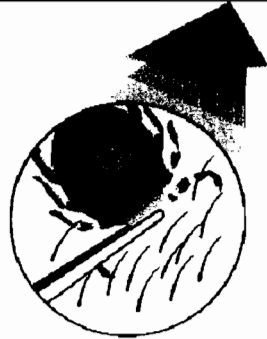
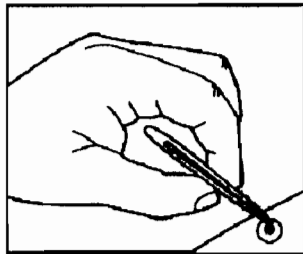
2. Tick Removal

Because it takes several hours of attachment before microorganisms are transmitted from the tick to the host, prompt removal of attached or crawling ticks is an important method of preventing disease. Remember, folklore remedies of tick removal do not work! Methods such as the use of petroleum jelly or hot matches may actually make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting disease.

The best method to remove an attached tick is with a set of fine tipped tweezers.



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- a. Use fine-tipped tweezers. When possible, avoid removing ticks with bare hands.
- b. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers.
- c. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms.
- d. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- e. Disinfect the tweezers.
- f. Save the tick for identification in case you become ill. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip lock bag and put it in the freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.

3. Medical Follow-Up

In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, individuals who are bitten by a tick

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should seek medical attention if any signs and symptoms of tick borne disease develop over the weeks following the tick bite.

B. Poisonous Plants

1. Background Information

Poison ivy and poison oak plants are the most common cause of allergic contact dermatitis in North America. These poisonous plants can be a hazard for many various outdoor activities at work, home, and play. Skin contact with the oleoresins (urushiol) from these plants can cause an itchy, red, oozing, blistered rash in sensitive individuals. Oil content in the plants is highest in the spring and summer, however the plants are even hazardous in the winter when they have dropped their leaves. There are three types of exposure:

- **Direct contact:** An initial skin exposure is necessary to "sensitize" the individual. Subsequent contact in a sensitized person will result in a rash appearing within 4 to 48 hours. Approximately 50-70 % of the population is sensitized. Poison plant dermatitis is usually characterized by areas of linear or streaked patches where branches of the plant brushed the skin.
- **Indirect contact:** Skin exposure can happen indirectly. Clothing, shoes, tools, personal protective equipment and other items can be contaminated with the oils and maintain potency for months.
- **Airborne smoke contact:** Never burn poison plants. Droplets of oil can be carried by smoke and enter the respiratory system causing a severe internal outbreak.

Poison plant rash is not contagious. Skin contact with blister fluid from an affected individual will not cause dermatitis in another sensitized person. Scratching the rash can only spread it to other parts of your body if the oil is still on your skin. After the oil has been washed off or absorbed by the skin, scratching will not spread the rash.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each and are green in the summer and red in the fall. Both plants also have greenish-white flowers and berries that grow in clusters. All parts of these plants are toxic.

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Poison Ivy grows as a small plant, vine, and as a shrub. Leaves always consist of three glossy leaflets.



Poison Ivy

Poison Oak grows as a shrub or vine. It has three leaflets that resemble oak leaves.



Eastern Poison Oak

Poison Sumac grows as a woody shrub or small tree from 5 to 25 feet tall. It has 7 to 13 leaves that grow opposite each other with a leaflet at the tip.



Poison Sumac

1. Precautionary Measures

- The best approach is to learn to identify the plants and avoid them.
- Wear long pants and long sleeves, boots and gloves.
- Barrier skin creams may offer some protection if applied before contact.

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- Avoid indirect contact from tools, clothing or other objects that have come into contact with a crushed or broken plant. Don't forget to wash contaminated clothing and clean up contaminated equipment.
- If you can wash exposed skin areas within 3-5 minutes with cold running water, you may keep the urushiol from penetrating your skin. Proper washing may not be practical in remote areas, but a small wash-up kit with pre-packaged alcohol-based cleansing tissues can be effective.

2. Medical Follow-Up

Home treatment: Calamine lotion and an oatmeal (one cup to a tub full of water) bath can help relieve itching. To prevent secondary skin infection, scratching is not helpful and the finger nails should be cut to avoid damage to the skin. Over-the-counter hydrocortisone cream can decrease inflammation and itching, however read the label and use according to directions.

When to see the doctor: Severe cases may require further treatment. A physician should be seen if the rash appears infected, is on the face or other sensitive body areas, or is too extensive to be easily treated at home.

C. Mosquito Borne Diseases

1. Background Information

- a. Arboviral encephalitis is a viral illness causing inflammation of the brain and is transmitted to humans by the bite of infected mosquitoes. Globally there are several strains including: Eastern equine, Japanese, La Crosse, St. Louis, West Nile, and Western equine encephalitis. Some of the strains have a vaccine. Symptoms of infection are nonspecific and flu-like: fever, headache, and tiredness. Fortunately, only a small proportion of infected people progress to encephalitis. Treatment is supportive, antibiotics are not effective.
- b. Malaria is a serious but preventable disease spread by the bite of an infected anopheline mosquito. It is caused by four species of the parasite *Plasmodium* (*P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*). Malaria-risk areas include primarily tropical areas of Central and South America, Africa, India, Southeast Asia, and the Middle East. Symptoms of malaria which occur 8 days to 1 year after infection

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include fever, shaking chills, headache, muscle ache, tiredness, jaundice, nausea, vomiting, and diarrhea. Malaria can be cured with prescription drugs.

- c. Dengue Fever is a potentially life-threatening viral illness transmitted by the bite of the Aedes mosquito, found primarily in urban areas. The disease is found in most of tropical Asia, the Pacific Islands, Central and South America, and Africa. There are four dengue virus serotypes. Symptoms include sudden onset, high fever, severe headache, joint and muscle pain, rash, nausea and vomiting. There is no specific treatment and no vaccine.
- d. Yellow Fever is a viral disease transmitted between humans by mosquitoes. It occurs only in Africa and South America. There is a vaccine that confers immunity lasting 10 years or more. Symptoms begin 3-6 days after the mosquito bite and include fever, nausea, vomiting, headache, slow pulse, muscle aches, and restlessness. Treatment is symptomatic.

2. Precautionary Measures

- Insect Repellent – Use insect repellants that contain DEET. The effect should last about 4 hours. Always use according to label directions. Use only when outdoors and wash skin after coming indoors. Do not breathe in, swallow, or get into the eyes. Do not put on wounds or broken skin.
- Protective Clothing – wear long sleeved shirts and long pants, especially from dusk to dawn. Or avoid going outdoors during these hours.
- Mosquito netting – Travelers who will not be staying in well-screened or air conditioned rooms should use a pyrethroid containing flying insect spray in living and sleeping areas during evening and nighttime hours. Sleep under mosquito netting (bed nets) that have been sprayed with permethrin.
- Malaria prophylaxis medications may be prescribed, however they do not provide complete protection. The type of medication given depends on the area of travel.

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D. Poisonous Snakes

1. Background Information

No single characteristic distinguishes a poisonous snake from a harmless one except the presence of poison fangs and glands. Only in dead specimens can you determine the presence of these fangs and glands without danger. Most poisonous snakes have both neurotoxic and hemotoxic venom, however, one type is dominant and the other is weak.

- a. Hemotoxic venom. The folded-fang snakes (fangs can raise to an erect position) have venoms that affect the circulatory system, destroying blood cells, damaging skin tissues, and causing internal hemorrhaging.
- b. Neurotoxic venom. The fixed-fang snakes (permanently erect fangs) have venoms that affect the nervous system, making the victim unable to breathe.
- c. Poisonous snakes in the Americas: copperhead, coral snake, cottonmouth, and rattlesnake.
- d. Poisonous snakes in Europe: adder, viper.
- e. Poisonous snakes of Africa and Asia: viper, cobra, adder, green mamba.
- f. Poisonous snakes in Australia: copperhead, adder, taipan, tiger snake.

2. Precautionary Measures

Bites occur when you don't hear or see the snake, when you step on them, or when you walk too close to them. Follow these simple rules to reduce the chance of accidental snakebite:

- Don't put your hands into dark places, such as rock crevices, heavy brush, or hollow logs, without first investigating.
- Don't step over a fallen tree. Step on the log and look to see if there is a snake resting on the other side.
- Don't walk through heavy brush or tall grass without looking down. Look where you are walking.

URS SAFETY MANAGEMENT STANDARD **Biological Hazards**

- Do not pick up any live snake. If you encounter a snake, walk around the snake, giving it plenty of room. A snake can strike half its length.
- Don't pick up freshly killed snakes without first severing the head. The nervous system may still be active and a dead snake can deliver a bite.

3. Medical Follow-up

If you are bitten by a snake, the primary goal is to get to a hospital as soon as possible to receive professional medical evaluation and possible treatment with antivenom if warranted. Initial first aid should include: Wash the bite with soap and water. Immobilize the bitten area and keep it lower than the heart. Try to remain calm. If you are unable to reach a hospital within 30 minutes, a bandage, wrapped two to four inches above the bite, may help slow the venom. The bandage should not cut off blood flow from a vein or artery, make sure the band is loose enough that a finger can slip under it. A suction device from a commercial snakebite kit may be placed over the bite to help draw venom out of the wound.

Research has shown the following to be potentially harmful, DO NOT: apply ice, use a tourniquet, or make incisions into the wound.

5. Documentation Summary

Complete and distribute a URS Incident Report form 49-1 for all work-related biological exposure incidents.

6. Resources

Centers for Disease Control
<http://www.cdc.gov>

U. S. Occupational Safety and Health Administration
<http://www.osha.gov>

U.S. Food and Drug Administration
Treating and Preventing Venomous Snake Bites

URS SAFETY MANAGEMENT STANDARD

Injury / Illness / Incident Reporting

1. Applicability

This procedure applies to URS Corporation offices and field operations.

2. Purpose and Scope

The purpose of this procedure is to provide guidance for the timely reporting of work related injuries, illness, and incidents.

3. Implementation

Office Locations - Implementation of this program is the responsibility of the employee's Supervisor.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Reporting: All employees shall immediately notify their appropriate level of management (line, project, and/or office) of a reportable incident. A reportable incident includes the following:

1. An injury to any URS employee, subcontractor, client representative, or private citizen, even if the injury does not require medical attention;
2. An injury to a member of the public occurring on a URS work site or possibly resulting from a URS or subcontractor activity or involving URS or subcontractor property, equipment, or resource;
3. Illness resulting from suspected chemical exposure;
4. Chronic or re-occurring conditions such as back pain or cumulative trauma disorders (example: carpal tunnel syndrome);
5. Fire, explosion, or flash;
6. Any vehicle accidents occurring on site, while traveling to or from client locations, or with any company-owned or leased vehicle;
7. Property damage resulting from any URS or subcontractor activity;
8. Structural collapse or potential structural hazards;

URS SAFETY MANAGEMENT STANDARD Injury / Illness / Incident Reporting

9. Unexpected release or imminent release of a hazardous material;
10. Unexpected chemical exposures to workers or the public;
11. A safety related complaint from the public regarding URS activities.
12. Any other significant occurrence that could impact safety.

B. Actions: The following actions will be taken following a reportable incident:

1. Employees:

- a. If necessary, suspend operations and secure and/or evacuate the area;
- b. Immediately notify your supervisor and/or project manager
- c. Record information pertaining to the incident (e.g., time, date, location, name and company of person(s) involved, description of event, and actions taken);
- d. Assist with incident investigation as directed by management;
- e. Implement corrective actions as directed by management;
- f. *Do not* discuss the incident with members of the news media or legal representatives (except URS legal counsel or your personal legal advisor) unless directed to do so by URS management;
- g. *Do not* make statements pertaining to guilt, fault, or liability.

2. Line/Project Management:

- a. Review circumstances of the incident with applicable employee(s);
- b. Notify local Health and Safety representative. If incident involves and an injury/illness of a URS employee, also notify the local Human Resources Representative;
- c. Complete and distribute injury/incident report within 24 hours. (Note: If the employee is unable to complete the

URS SAFETY MANAGEMENT STANDARD

Injury / Illness / Incident Reporting

report, another company employee, line manager, project manager, or local health and safety representative may complete the report.);

- d. Review and verify that necessary corrective actions are identified and implemented;
- e. Discuss with department or project staff the circumstances surrounding the incident and corrective actions taken.

3. Local Health And Safety Representative

- a. Assist with incident evaluation;
- b. With management, identify cause(s) of incident and identify corrective actions needed to avoid recurrence;
- c. Review injury/incident report for completeness and accuracy;

4. Local Human Resources Representative

- a. Report work-related injuries and illness to worker compensation carrier

(St. Paul Fire and Marine @ 1-800-787-2851);

5. Documentation Summary

A. File these records in the Office Safety File:

- 1. Attachment 49-1 - Incident Report Form
- 2. Maintain OSHA 200 Log.

B. File these records in the Project Health and Safety File

- 1. Attachment 49-1 - Incident Report Form
- 2. Maintain OSHA 200 Log if applicable for Project.

6. Resources

A. U. S. OSHA

B. Attachment 49-1 - Incident Report Form

URS SAFETY MANAGEMENT STANDARD

Bloodborne Pathogens

1. Applicability

This program applies to all employees who may incur exposure to blood or other potentially infectious body fluids as a result of performing their assigned job duties. Examples include: designated first aid responders or work assignment at a client's medical laboratory site. Note: Sewage work does not typically involve exposure to bloodborne pathogens even though other biological hazards may be present.

2. Purpose and Scope

The purpose of this program is to identify jobs and tasks where occupational exposure to bloodborne pathogens (i.e. Human Immunodeficiency Virus, Hepatitis B and C Viruses, and others) may occur and to implement controls which will eliminate or significantly reduce the risk of infectious bloodborne diseases in accordance with the OSHA Bloodborne Pathogen Standard (29 CFR 1910.1030). This program also includes provisions for affected employees to receive personal protective equipment, Hepatitis B vaccinations, training, and if necessary, confidential medical evaluations and follow up.

3. Implementation

Office/Laboratory Locations – Implementation is the responsibility of the Operations Manager.

Field Activities – Implementation is the responsibility of the Project Manager.

Program Administration – The Occupational Health Specialist (OHS) and URS Health & Safety Director are responsible for implementation and annual evaluation of the Exposure Control Plan (ECP) – Attachment 51-1. The OHS will ensure that all medical actions required are performed and that the appropriate employee health and OSHA records are maintained. The URS Health & Safety Director will oversee provisions of necessary personal protective equipment and supplies, training, documentation of training, and will make the written ECP available to employees and OSHA representatives.

4. Requirements

A. Risk Identification

1. The Project Manager, with assistance from the site Health & Safety Representative, will perform an exposure determination concerning

URS SAFETY MANAGEMENT STANDARD

Bloodborne Pathogens

which employee may or may not have exposure to bloodborne pathogens. Employees will be classified into two categories:

- a. Employees formally designated as part of their job to perform tasks that may involve direct contact with blood or potentially infectious body fluids.
 - i. Requires initial and annual training
 - ii. Hepatitis B vaccination series will be offered
 - iii. Requires procedures be followed in ECP
 - b. Employees not assigned to jobs or tasks that involve exposure to blood or potentially infectious body fluids, but who could in extraordinary situations, voluntarily assist injured or ill individuals, and therefore could have exposure to bloodborne pathogens.
 - i. Requires post-exposure procedures outlined in ECP
2. The ECP will be reviewed and updated at least annually, and whenever necessary to include new or modified tasks and procedures.

B. Exposure Control Methods

1. All employees will utilize universal precautions – an approach to infection control where all human blood and body fluids are treated as potentially infectious.
2. Engineering and work practice controls (e.g. sharps disposal containers, perform procedures to prevent splashing) will be used to eliminate or minimize exposure to employees.
3. Personal protective equipment (e.g. disposable gloves, face masks with eye protection, liquid impermeable gowns, CPR pocket masks) will be provided and used in order to place a barrier between the employee and the blood or body fluids.
4. Hands are to be washed immediately with soap and water after removing gloves or performing any work with blood or body fluids.

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5. Housekeeping and decontamination of work surfaces with EPA-registered germicides or a bleach solution diluted 1:10 with water, will be performed as needed to maintain a safe working environment.
 6. Regulated biohazardous waste (contaminated sharps or items that are capable of releasing blood or body fluids through employee handling) will be disposed of in special waste receptacles lined with red bags and incinerated per federal and state regulations. This does not include small amounts of waste from a minor wound which can be sealed in a plastic bag and disposed of in regular trash.
- C. Hepatitis B Vaccination series will be made available to all employees who have been designated to perform tasks that involve direct exposure to bloodborne pathogens. Further, this vaccination series will be made immediately available to employees that have had an occupational bloodborne exposure incident, whether as a result of their assigned tasks or occurring as a result of incidental contact.
- D. In the event that an employee is exposed to blood or body fluids, they should immediately flush the affected area with copious amounts of water. A confidential medical evaluation and follow-up with an occupational physician should be arranged for the employee as soon as possible following the report of an exposure incident, preferably within 1-2 hours after the exposure incident has occurred.
- E. Hazard Communication
1. Orange-red biohazard warning labels will be used to identify lab areas or disposal containers with blood or other potentially infectious materials present.
 2. Initial and annual training classes will be conducted by the Division Health & Safety Managers for all employees assigned to tasks where occupational exposure may occur.

F. Exposure Incident Investigation

The OHS and Division Health & Safety Manager will review the circumstances of each exposure incident to determine if the appropriate work procedures were being followed at the time of the incident and to assess and implement any necessary corrective actions, including changes required in the ECP.

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5. Documentation Summary

- A. Distribute Medical Surveillance Evaluation form to Medical Services Provider, site Health & Safety Representative, and Supervisor.
- B. Post-exposure medical records from consulting physician and exposure incident reports will be retained in employee's confidential medical record.
- C. Send initial and annual training records to the Division Health & Safety Manager.
- D. Regulated infectious medical waste manifest records will be stored by the site Health & Safety Representative.

6. Resources

- A. U.S. OSHA 29 CFR 1910.1030 Occupational Exposure to Bloodborne Pathogens Standard, current revision.
(http://www.osha-slc.gov/OshStd_data/1910_1030.html)
- B. Centers for Disease Control Morbidity and Mortality Weekly Report: "Public Health Service Guidelines for the Management of Health-Care Worker Exposure to HIV and Recommendations for Post-exposure Prophylaxis" May 15, 1998; Vol. 47, No. RR-7.
(<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00052722.htm>)
- C. Centers for Disease Control Morbidity and Mortality Weekly Report: "Immunization of Health-Care Workers: Recommendations" December 26, 1997; Vol. 46, No. RR-18.
(<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00050577.htm>)
- D. Centers for Disease Control Morbidity and Mortality Weekly Report: "Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease" October 16, 1998; Vol. 47, No. RR-19.
(<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00055154.htm>)
- E. Bloodborne pathogens standard and the construction industry (OSHA letter of interpretation 01-26-93)
(http://www.osha-slc.gov/OshDoc/Interp_data/I19930420A.html)
- F. Clarification on first aid requirements for hazardous waste sites (OSHA letter of interpretation 04-20-93)

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(http://www.osha-slc.gov/OshDoc/Interp_data/I19930420A.html)

- G. Worksafe Australia: National Occupational Health & Safety Commission. National Code of Practice for health care workers and other people at risk of the transmission of Human Immunodeficiency Virus and Hepatitis B in the workplace. [NOHSC: 2010(1993)]
(http://www.worksafe.gov.au/publications/fulltext/codes/nohsc2010_toc.htm)

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Drilling Safety Guidelines

1. Applicability

This program applies to URS projects in which truck-mounted, or other engine powered, drill rigs are used. It is applicable to URS employees and URS owned rigs. For drill rigs operated by contractors, the primary responsibility for drilling safety is with the drilling contractor.

2. Purpose and Scope

The purpose of these guidelines is to provide an overview for working safely around drilling operations with truck-mounted and other engine-powered drill rigs. The procedure addresses off-road movement of drill rigs, overhead and buried utilities, use of augers, rotary and core drilling, and other drilling operations and activities.

3. Implementation

Field Activities Drill rig safety and maintenance is the responsibility of the drill rig operator. URS employees are responsible for their own safety including recognizing and avoiding drill rig hazards. URS employees that observe a drill rig condition believed to be unsafe shall advise the drill rig operator of the unsafe condition.

4. Safety Guidelines

A. General Guidelines

URS technicians, geologists, engineers, or other field staff assigned to observe drilling operations or collect soil samples should observe the following guidelines:

- Require a meeting at project start-up regarding the drill rig operator responsibility for rig safety and any site and equipment specific safety requirements
- Set up any sample tables and general work areas for the URS field staff to the side of the drill rig (preferably 10 meters away) and not directly behind the rig.
- URS engineers, technician, and geologists shall not assist the drillers with the drilling equipment or supplies and shall not at any time operate the drill rig controls.

B. Movement of Drill Rigs

Before moving a rig, the operator must do the following:

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- To the extent practical, walk the planned route of travel and inspect it for depressions, gullies, ruts, and other obstacles.
- Check the brakes of the truck/carrier, especially if the terrain along the route of travel is rough or sloped.
- Discharge all passengers before moving on rough or steep terrain.
- Engage the front axle (on 4x4, 6x6, etc. vehicles) before traversing rough or steep terrain.

Driving drill rigs along the sides of hills or embankments should be avoided; however, if side-hill travel becomes necessary, the operator must conservatively evaluate the ability of the rig to remain upright while on the hill or embankment. The possibility must be considered that the presence of drilling tools on the rig may reduce the ability of the rig to remain upright (raises the center of mass of the rig).

Logs, ditches, road curbs, and other long and horizontal obstacles should be normally approached and driven over squarely, not at an angle.

When close lateral or overhead clearance is encountered, the driver of the rig should be guided by another person on the ground.

Loads on the drill rig and truck must be properly stored while the truck is moving, and the mast must be in the fully lowered position.

After the rig has been positioned to begin drilling, all brakes and/or locks must be set before drilling begins. If the rig is positioned on a steep grade and leveling of the ground is impossible or impractical, the wheel of the transport vehicle should be blocked and other means of preventing the rig from moving or topping over employed.

C. Buried and Overhead Utilities

The location of overhead and buried utility lines must be determined before drilling begins, and the locations should be noted on boring plans and/or assignment sheets.

When overhead power lines are close by, the drill rig mast should not be raised unless the distance between the rig and the nearest power line is at least 20 feet (7 meters) or other distance as required by local ordinances, whichever is greater. The drill rig operator or assistant should walk completely around the rig to make sure that proper distance exists.

When the drill rig is positioned near an overhead line, the rig operator should be aware that hoist lines and power lines can be moved towards each other by wind. When necessary and approved by the Project

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Manager (PM), the utility and/or power lines may be shielded, shut down, or moved by the appropriate personnel.

For additional information, please refer to SMS #34 "Utility Clearances and Isolation".

D. Clearing the Work Area

Before a drill rig is positioned to drill, the area on which the rig is to be positioned should be cleared of removable obstacles and the rig should be leveled if sloped. The cleared/leveled area should be large enough to accommodate the rig and supplies.

E. Safe Use of Augers

Never place hands or fingers under the bottom of an auger flight or drill rods when hoisting the augers or rods over the top of another auger or rod in the ground or other hard surfaces, such as the drill rig platform.

Never allow feet to get under the auger or drill rod while they are being hoisted.

When the drill is rotating, stay clear of the drill string and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.

Move auger cuttings away from the auger with a long-handled shovel or spade; never use hands or feet.

Never clean an auger attached to the drill rig unless the transmission is in neutral or the engine is off, and the auger has stopped rotating.

Do not wear loose clothing or jewelry while working near the drill rig. Long hair must be pulled back to avoid entanglement with moving parts.

Hearing protection is required when working near an operating drill rig.

F. Safe Use of Hand Tools

Regulations regarding hand tools should be observed in addition to the guidelines provided below:

- Each tool should be used only to perform tasks for which it was originally designed.
- Damaged tools should be repaired before use or discarded.
- Safety goggles or glasses should be worn when using a hammer or chisel. Nearby co-workers and by-standers should be required to wear safety goggles or glasses also, or move away.

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- Tools should be kept cleaned and stored in an orderly manner when not in use.

G. Safe use of Wire Line Hoists, Wire Rope, and Hoisting Hardware

Safety rules described in Title 29 Code of Federal Regulations (CFR) 1926.552 and guidelines contained in the Wire Rope User's Manual published by the American Iron and Steel Institute shall be used whenever wire line hoists, wire rope, or hoisting hardware are used. The driller should provide written reports (upon request) documenting inspections of equipment.

H. Traffic Safety

Drilling in streets, parking lots or other areas of vehicular traffic requires definition of the work zones with cones, warning tape, etc. and compliance with local police requirements.

I. Fire Safety

- Fire extinguishers (type ABC) shall be kept on or near drill rigs for fighting small fires.
- If methane or other flammable gases or vapors are suspected in the area, a combustible gas indicator (CGI) shall be used to monitor the air near the borehole with all work to stop at 20 percent of the Lower Explosive Limit (LEL).
- Work shall stop during lightning storms.

J. Protective Gear

1. Minimum Protective Gear

Items listed below should be worn by all staff working within 30 feet (10 meters) of drilling activities.

- Hearing Protection;
- Hard Hat;
- Eye Protection (safety glasses, goggles, or face-shield)
- Safety Shoes (shoes or boots with steel toes)

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Drilling Safety Guidelines

2. Other Gear

Items listed below should be worn when conditions warrant their use. Some of the conditions are listed after each item.

- **Safety Harnesses and Lifelines:** Safety harnesses and lifelines shall be worn by all persons working on top of an elevated derrick beam or mast. The lifeline should be secured at a position that will allow a person to fall no more than six feet (2 meters). OSHA Fall Protection (1926 Subpart M) requirements apply.
- **Life Vests:** Use for work over water.

5. Resources

- A. International Association of Drilling Contractors Safety Alerts
<http://iadc.org/alerts.htm>
- B. Fall Protection - SMS 040
- C. Hearing Conservation - SMS 026
- D. Subcontractor Health and Safety Requirements - SMS - 046
- E. Utility Clearances and Isolation - SMS 034

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Cold Stress

1. Applicability

This procedure applies to URS projects where field crews are working outdoors in damp and cool (below 50° F or 10°C) conditions or anytime temperatures are below 32°F or 0°C.

2. Purpose and Scope

The purpose of this procedure is to protect project personnel from the following conditions:

Hypothermia: Hypothermia results when the body loses heat faster than it can be produced. When this situation first occurs, blood vessels in the skin constrict in an attempt to conserve vital internal heat. Hands and feet are first affected. If the body continues to lose heat, involuntary shivers begin. This is the body's way of attempting to produce more heat, and it is usually the first real warning sign of hypothermia. Further heat loss produces speech difficulty, confusion, loss of manual dexterity, collapse, and finally death. Wet clothes or immersion in cold water greatly increases the hypothermia risk. The progressive clinical presentation of hypothermia may be seen in Attachment 59-1.

Frostbite: Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite can be categorized into:

- **Frost Nip or Initial Frostbite:** (1st degree frostbite) Characterized by blanching or whitening of skin.
- **Superficial Frostbite:** (2nd degree frostbite) Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient. Blistering and peeling of the frozen skin will follow exposure.
- **Deep Frostbite:** (3rd degree frostbite) Tissues are cold, pale, and solid; extremely serious injury with possible amputation of affected area.

Frostbite can occur without hypothermia when the extremities do not receive sufficient heat. The toes, fingers, cheeks, and ears are the most commonly affected. Frostbite occurs when there is freezing of the fluids around the cells of the affected tissues. The first symptom of frostbite is an uncomfortable sensation of coldness, followed by numbness. There may be tingling, stinging, or cramping. Contact by the skin with tools or other metal objects below 20°F (-7°C) may result in contact frostbite.

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3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager and the field supervisor.

4. Requirements

- A. Carefully plan work anticipated to be performed in cool or cold conditions. Include costs in project budgets for specialized equipment and supplies needed to complete the field activities.
- B. Monitor weather forecasts immediately prior to entering the field.
- C. Observe and monitor weather conditions such as ambient temperature, wind speed, and precipitation while in the field. Use Attachment 59-2 to determine wind chill.
- D. Wear at least 3 layers of clothing.

- An outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon)
- A middle layer of down, wool, or similar materials to provide insulation
- An inner layer of cotton or synthetic weave to allow ventilation

In addition:

- Wear a hat. Up to 40% of body heat can be lost when the head is left exposed.
 - Wear insulated boots or other insulated footwear.
 - Keep a change of dry clothing available in case work clothes become wet.
 - Do not wear tight clothing. Loose clothing allows better ventilation.
- E. Use the following work practices:
- Use Attachment 59-3 to establish work/rest cycles in cold weather.
 - Drink plenty of warm liquids. It is easy to become dehydrated in cold

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weather.

- Avoiding caffeine and alcohol. Alcohol will accelerate loss of body heat.
- Eat high calorie snacks to help maintain body metabolism.
- If possible, heavy work should be scheduled during the warmer parts of the day. Take breaks out of the cold.
- Work in pairs to keep an eye on each other and watch for signs of cold stress.
- NEVER IGNORE SHIVERING. Persistent or violent shivering is a clear warning that you are on the verge of hypothermia.
- Avoid exhaustion.

F. When possible, use the following engineering controls:

- Provide shelter to escape cold, wind and precipitation
- Provide a source of heat (such as warm packs or portable heaters)
- Use insulating materials on equipment handles when temperatures drop below 30°F or -1°C.

G. Watch for symptoms and signs of hypothermia (see Attachment 59-1).

H. Treat cold stress illness as follows:

- Hypothermia: Prompt treatment of hypothermia is essential. Once the body temperature drops below 95°F or 35°C, the loss of temperature control occurs, and the body can no longer rewarm itself. Initial treatment includes reducing heat loss by moving the individual out of the wind and cold, removal of wet clothing, applying external heat (such as a pre-warmed sleeping bag, electric blanket, or body-heat from other workers) and follow-up medical attention.
- Frost Bite: The initial treatment for frostbite includes bringing the individual to a warm location, removal of clothing in the affected area, and, **if help is delayed**, placing the affected parts in warm (100° to 104° F or 38° to 40°C) water. Do not massage or rub the frostbite area. After

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the initial treatment, wrap the affected area loosely in sterile gauze and seek medical attention.

For further discussion on Cold Stress treatment, please refer to Attachment 59-1

I. Hypothermia in Water:

Loss of body heat to the water is a major cause of deaths in boating accidents. Often the cause of death is listed as drowning; however the primary cause is often hypothermia. It should also be noted that alcohol lowers the body temperature around two to three degrees by dilating the blood vessels. Do not drink alcohol around cold water. The following table shows the effects of hypothermia in water:

WATER TEMPERATURE	EXHAUSTION	SURVIVAL TIME
32.5° F (0°C)	Under 15 min.	Under 15 to 45 min.
32.5 to 40°F (0 – 4°C)	15 to 30 min.	30 to 90 min.
40 to 50°F (4 – 10°C)	30 to 60 min.	1 to 3 hrs.
50 to 60°F (10 – 16°C)	1 to 2 hrs.	1 to 6 hrs.
60 to 70°F (16 – 21°C)	2 to 7 hrs.	2 to 40 hrs.
60 to 70°F (16 – 21°C)	3 to 12 hrs.	3 hrs. to indefinite
Over 80°F (27°C)	Indefinite	Indefinite

SOME POINTS TO REMEMBER:

- Wear your PFD. Review SMS 053 - Marine Safety and Boat Operations.
- If water is less than 50°F (10°C), wear a wet suit or dry suit for work in water (e.g., wading) or if significant potential to fall in water.
- While in the water, do not attempt to swim unless to reach nearby safety. Unnecessary swimming increases the rate of body heat loss. Keep your head out of the water. This will increase your survival time.

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- Keep a positive attitude about your rescue. This will increase your chances of survival.
- If there is more than one person in the water, huddling is recommended.

J. Training

Workers at risk of developing hypothermia or cold-related injury will be trained in:

- recognition of the signs and symptoms of cold injury or impending hypothermia,
- proper re-warming procedures and appropriate first aid treatment,
- proper use of clothing,
- proper eating and drinking practices
- safe work practices appropriate to the work that is to be performed.

5. Documentation Summary

File these records in the Project Safety File.

- A. Completed Project Hazard Analysis form (see Health and Safety Website – "Hazard Analysis")
- B. Cold stress training records

6. Resources

- A. OSHA Fact Sheets – "Protecting Workers in Cold Environments"
http://www.osha-slc.gov/OshDoc/Fact_data/FSNO98-55.html
- B. Attachment 59-1 "Signs of, and Treatment for, Cold Stress related Illnesses"
- C. Attachment 59-2(a) "Wind Chill Index" (units in °F and miles/hour)
- D. Attachment 59-2(b) "Wind Chill Index" (units in °C and Kilometers/hour)
- E. Attachment 59-3 "TLVs Work/Warm-up Schedule for Outside Workers based on a Four-hour Shift"

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Attachment 59-1
Signs of and Treatment for Cold Stress Related Illnesses

Condition	Signs/Symptoms	Treatment
Hypothermia Mild (98° - 90° F) (36° - 32°C)	• shivering • lack of coordination • stumbling, fumbling hands • slurred speech • memory loss • pale, cold skin	• move to warm area • stay active • remove wet clothes and replace with dry clothes or blankets • cover the head • drink warm (not hot) sugary drink
Hypothermia Moderate (90° - 86° F) (32° - 30°C)	• shivering stops • unable to walk or stand • confused and irrational	• All of the above, plus • Call for an ambulance • Cover all extremities completely • Place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin
Hypothermia Severe (86° - 78° F) (30° - 26°C)	• severe muscle stiffness • very sleepy or unconscious • ice cold skin • death	• Call for an ambulance • Treat the victim very gently • Do not attempt to re-warm -- the victim should receive treatment in a hospital
Frostbite	• Cold, tingling, stinging or aching feeling in frostbitten area; numbness • Skin color turns red, then purple, then white or very pale skin, cold to the touch • Blisters in severe cases	• Seek medical attention • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm, not hot, water
Trench Foot	• Tingling, itching or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm, sugary drink

Source: Princeton University, Department of Environmental Health and Safety, posted 2/2/99.

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Attachment 59-2(a)
Wind-Chill Index¹
(miles per hour and °F.)

	ACTUAL THERMOMETER READING (°F)									
	50	40	30	20	10	0	-10	-20	-30	-40
Wind speed in mph	EQUIVALENT TEMPERATURE (°F)									
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (little added effect)	Little Danger (for properly clothed person)				Increasing Danger			Great Danger (Danger from freezing of exposed flesh)		

¹ Source: Fundamentals of Industrial Hygiene, Third Edition. Plog, B.A., Benjamin, G.S., Kerwin, M.A., National Safety Council, 1988

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Attachment 59-2(b) Wind-chill Index¹ (Kilometers per hour and °C.)

Estimated wind speed	Actual temperature reading (°C)												
	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
(in km/h)	Equivalent chill temperature (°C)												
0 (Calm)	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
8	9	3	-2	-7	-12	-18	-23	-28	-33	-38	-44	-49	-54
16	4	-2	-7	-14	-20	-27	-33	-38	-45	-50	-57	-63	-69
24	2	-5	-11	-18	-25	-32	-38	-45	-52	-58	-65	-72	-78
32	0	-7	-14	-21	-28	-35	-42	-50	-56	-64	-71	-78	-84
40	-1	-8	-16	-24	-31	-38	-46	-53	-60	-67	-76	-82	-90
48	-2	-10	-17	-26	-33	-40	-48	-55	-63	-70	-78	-86	-94
56	-3	-11	-18	-26	-34	-42	-50	-58	-65	-73	-81	-89	-96
64	-3	-11	-19	-27	-35	-43	-51	-59	-66	-74	-82	-90	-98
(Wind speeds greater than 64 km/h have little additional effect.)	LOW HAZARD Risk of exposed, dry skin being affected in less than one hour. Awareness of hazard low.			INCREASING HAZARD Danger from freezing of exposed flesh within one minute.				HIGH HAZARD Flesh may freeze within 30seconds.					

The table was originally developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA, and is adapted from the 1995-1996 *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, published by the ACGIH. The ACGIH publication provides the equivalent table with temperature in degrees Fahrenheit and wind speed in mph.

Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36°C (96.8°F).

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Attachment-59-3

TLVs Work/Warm-up Schedule for Outside Workers based on a Four-hour Shift*

The ACGIH has adopted the guidelines developed by the Saskatchewan Labour for working outdoors in cold weather conditions. These guidelines recommend protective clothing and limits on exposure time. The recommended exposure times are based on the wind chill factor, a scale based on air temperature and wind speed. The work-break schedule applies to any four-hour period with moderate or heavy activity. The warm-up break periods are of 10-minute duration in a warm location. The schedule assumes that "normal breaks" are taken once every two hours. At the end of a 4-hour period, an extended break (e.g. lunch break) in a warm location is recommended. More information is available in the ACGIH publications "2000 TLVs and BEIs" and "Documentation of TLVs and BEIs" and on the Saskatchewan Labour web page "[Cold Conditions Guidelines for Outside Workers](#)".

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. work Period	No. of Breaks* *	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29°to -31°	-20°to -24°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25°to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease					
-40° to -42°	-40°to -44°	30 min.	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

*2000 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati : American Conference of Governmental Industrial Hygienists (ACGIH), 2000 - page 176. Adopted from Saskatchewan Labour "[Cold Conditions Guidelines for Outside Workers](#)"

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ATTACHMENT D

FORMS



Health and Safety Program
**CORROSIVE AND REACTIVE
MATERIALS INSPECTION SHEET**

Attachment 9-1

Location: _____

Name of Inspector: _____ Date Inspected: _____

"NO" answers indicate an unsafe situation or problem

		Yes	No	N/A
Labeling				
1.	Containers are labeled with: • Name of chemical • Signal work (DANGER; WARNING; CAUTION, etc.) • Manufacturer			
Pre-Job Activities				
2.	Corrosives are stored in a cool, dry environment, free from temperature extremes.			
3.	Corrosives are stored in their properly labeled original containers and cushioned against shock.			
4.	Corrosives are not stored in the vicinity of oxidizers.			
5.	Hydrofluoric acid is stowed only in acid-proof polyethylene or ceresin lined containers.			
6.	Corrosives are stored on acid resistant material (metal, plastic, etc.).			
7.	Chromic acid, nitric acid, perchloric acid, potassium permanganate (all oxidizers) are stored separately from other corrosives and flammables.			
Handling				
8.	The minimum required PPE issued when working with corrosives: • Chemical splash goggles. • Chemical resistant gloves. • Chemical resistant apron.			
9.	Bottles or carboys are opened slowly to guard from splashes.			
10.	The outside of the container is washed off with water after use to clean off any droplets of material.			
11.	An eyewash is located in all areas where corrosives are used.			
12.	An eyewash is: • Within 25 feet or 10 seconds travel; • Marked with a visible sign; • Well lit and visible; • Working and delivering a minimum of 1.5 liters of water/min. for 15 min.			
Waste Disposal				
13.	Organic acid, inorganic acid and basic waste is kept segregated.			
14.	Only minor amounts of acid or base (less than 3 oz. or 100 ml are flushed down the drain into the sanitary sewer.			
15.	Corrosive waste is turned in to a contract hazardous waste disposal company.			

Comments:

“Class I Locations”

Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations include the following:

- A. Class I, Division 1 location is a location:
 - 1. In which ignitable concentrations of flammable gases or vapors may exist under normal operating conditions; or
 - 2. In which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or
 - 3. In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors, and might also cause simultaneous failure of electric equipment.
- B. Class I, Division 2 location is a location:
 - 1. In which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment; or
 - 2. In which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment; or
 - 3. That is adjacent to a Class I, Division 1 location, and to which ignitable concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

“Class II Locations”

Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations include the following:

- A. Class II, Division 1 location is a location:

1. In which combustible dust is or may be in suspension in the air under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures; or
 2. Where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, operation of protection devices, or from other causes, or
 3. In which combustible dusts of an electrically conductive nature may be present.
- B. Class II, Division 2 location is a location in which:
1. Combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus; or
 2. Dust may be in suspension in the air as a result of infrequent malfunction of handling or processing equipment, and dust accumulations resulting therefrom may be ignitable by abnormal operation or failure of electrical equipment or other apparatus.

“Class III Locations”

Class III locations are those that are hazardous because of the presence of easily ignitable fibers or flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations include the following:

- A. Class III, Division 1 location is a location in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.
- B. Class III, Division 2 location is a location in which easily ignitable fibers are stored or handled, except in process of manufacture.



Health and Safety Program

**PPE, TOOLS AND EQUIPMENT
NEEDED DURING ELECTRICAL WORK**

Attachment 12-2

If there is a danger of:	Then use the following:
• Head injury from electric shock, or • Burns due to contact with exposed energized parts	Nonconductive head protection – Class II nonconductive hard hat
Injury to the eyes or face from: • electric arcs or flashes; or • flying objectives resulting from electrical explosion	Protective equipment for the eyes and face – face shield and safety glasses
Shock to hands while handling energized wires	Lineman's rubber insulated gloves rated for the voltage exposed to: leather overgloves may be needed if exposure to abrasive surfaces is possible.
• shock while working in areas where high voltage electrical systems are present, or • shock when performing electrical repairs	Non-conductive protective foot wear
Exposure to electric arcing or flashing from: • opening or closing 2400 volt oil cutout switching devices; • removing or installing links in high voltage able tap boxes; or • removing or installing fuses in high voltage circuits.	Protective coveralls made of Nomex or other suitable flash-proof material.
IF	THEN
Energized parts are exposed.	Use nonconductive ropes and handlines near the exposed energized part.
Working near exposed energized conductors or circuit parts.	Use insulated tools or handling equipment if the tools or handling equipment might make contact with such conducts or parts.
The insulating capability of insulated tools or handling equipment is subject to damage.	Protect the insulating material.
Removing or installing fuses when the fuse terminals are energized.	Use fuse-handling equipment, insulated for the circuit voltage.
Working near exposed energized parts that might be accidentally contacted or where dangerous electric heating or arcing might occur.	Use protective shields, protective barriers, or insulating materials to protect from shock, burns, or other electrically related injuries.
Normally enclosed live parts are exposed for maintenance or repair.	Guard the parts to protect unqualified persons from contact with the live parts.



Health and Safety Program
ELECTRICAL HAZARD CHECKLIST

Attachment 12-3

Location Inspected: _____ Job No.: _____

Date Inspected: _____ Name of Inspector: _____

Check Yes, No or N/A for Not Applicable. If comment is required, circle the number and see Page 3.

		Yes	No	N/A
Electrical Equipment Markings				
1.	Disconnecting switches and circuit breakers are labeled to indicate their use or equipment served.			
2.	The necessary voltage, wattage, or current ratings are labeled.			
3.	Circuit breakers clearly indicate whether they are in the "on" or "off" position.			
Electrical Grounding				
4.	Extension cords used have a grounding conductor (third plug).			
5.	GFCI's are installed as required.			
6.	Portable electrical tools and equipment are of the double insulated type.			
7.	Ground fault circuit interrupters open the circuit on a ground current of 5 milliamperes or greater and are equipped with an integral push button test circuit.			
8.	Ground fault circuit interrupters are installed in accordance with the manufacturer's instructions.			
9.	Ground fault circuit interrupters are tested prior to initial use and periodically thereafter.			
10.	Grounding rods are at least 5/8-inch diameter steel or iron rods, 1/2-inch diameter copper clad steel, or 3/4-inch diameter galvanized pipe.			
11.	Grounding rods are in eight-foot lengths and driven to full depth.			
12.	The path from circuits, equipment, structures, and conduits or enclosures to ground are:			
13.	• Permanent and continuous			
14.	• Have ample carrying capacity for the current likely to be imposed on it.			
15.	• Have resistance sufficiently low to permit current flow to operate circuit breakers and similar overcurrent devices on the circuit.			
16.	Driven ground rod electrodes have a resistance to ground not exceeding 25 ohms.			
17.	Upon installation of the driven ground rod electrode, the resistance was tested and recorded.			
18.	Conductors, used for bonding and grounding circuits, are of sufficient size to carry the anticipated current.			
19.	Grounds are not removed until all work is complete.			

		Yes	No	N/A
Electrical Guarding				
20.	Switches, receptacles, etc. are provided with tight-fitting covers or plates.			
21.	All energized parts of electrical circuits and equipment are guarded against accidental contact by approved cabinets or enclosure.			
22.	All unused openings (including conduit knockouts) in electrical enclosures and fittings are enclosed with appropriate covers, plugs or plates.			
23.	Ground-fault circuit interrupters are installed on each temporary 15 or 20 ampere, 120 volt AC circuit at locations where construction, demolition, modifications, alterations or excavations are being performed.			
24.	Electrical switches and breakers (rated 440 volts or greater) are provided with a means for locking them out in the OFF position.			
Electrical Systems				
25.	Circuit breakers accessible to personnel are protected from physical damage, and located away from ignitable material.			
26.	Weatherproof cabinets or enclosures are used when switches, circuit breakers, fuse panels and motor controllers are in a wet or outside location.			
27.	A readily accessible, manually operated switch is provided for each incoming service or supply circuit rated less than 5 kilovolts.			
28.	Electrical raceways and enclosures are securely fastened in place.			
29.	Overcurrent protection is provided for fuses or circuit breakers for each feeder and branch circuit.			
30.	Insulating fuse tongs or extractors are used when removing fuses from circuits rated 50-600 volts.			
31.	Fuse cabinets have close-fitting doors that can be locked.			
Extension Cords				
32.	Clamps or other securing means are provided on flexible cords or cables at plug receptacles, tools, equipment, etc. and the cord jacket is securely held in place.			
33.	Flexible cords and cables are free of splices and taps.			
34.	Only 3-wire grounded type extension cords, designated for hard or extra hard service are used.			
35.	Extension cords are listed by Underwriters Laboratories, Inc.			
36.	Extension cords are checked for damage before use.			
37.	The rated load on extension cords is not exceeded.			
38.	Extension cords are not fastened with staples, hung by nails or suspended by wire.			
Temporary Wiring				
39.	Temporary wiring is guarded, buried or isolated by elevation to prevent accidental contact by workers and equipment.			
40.	A vertical clearance above walkways for temporary wiring is not less than ten feet from circuits carrying 600 volts or less.			



Health and Safety Program
ELECTRICAL HAZARD CHECKLIST

Attachment 12-3

		Yes	No	N/A
41.	All exposed temporary wiring is supported on insulators.			
42.	Temporary wiring is protected from accidental damage.			
43.	Nonconductive lamp sockets and connections are permanently molded to the conductor insulation on lighting strings.			
44.	Lighting strings have lamp guards.			
45.	Broken or defective bulbs are replaced promptly.			
46.	Lights are protected from accidental contact or breakage.			
47.	Wiring installed in conduit is equipped with bushings at outlets and terminals.			
48.	Receptacles are of the grounding type, and electrically connected to the equipment-grounding conductor.			
Worker Practices				
49.	Personnel performing electrical repairs are properly trained and "qualified".			
50.	Workers de-energize, ground or guard electric circuits before working in close proximity.			
51.	Workers consider all electrical systems as hot, until verified de-energized and grounded.			
52.	Proper lockout tag-out procedures are used for de-energizing electric circuits.			
Equipment				
53.	Only fiberglass or wood ladders are used when working near electrical hazards.			
54.	Insulation mats are placed on floors and on frames of equipment when working on energized equipment.			
Personal Protective Equipment				
55.	Rubber matting, blankets, insulated sleeves, and rubber gloves are inspected before use.			
56.	Workers use safety glasses and face shields during work activities where there is a reasonable probability of eye injury.			

COMMENTS:

"Type A" soils

Are cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144kPa) or greater.

Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A.

However, no soil is Type A if:

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

"Type B" soils are:

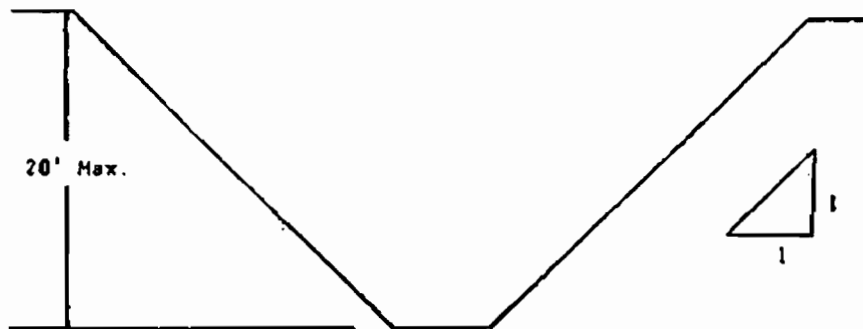
- i. Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
- ii. Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
- iii.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

"Type C" soils are:

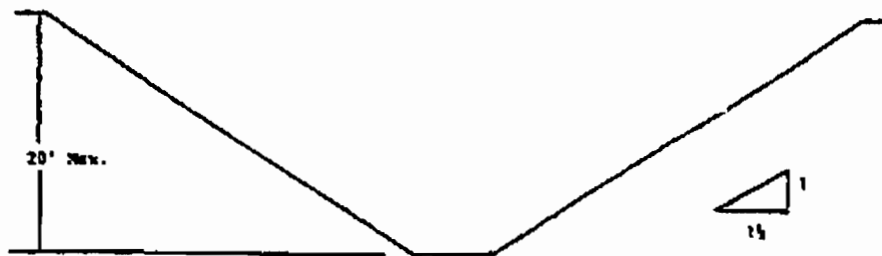
- i. Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
- ii. Granular soils including gravel, sand, and loamy sand; or
- iii. Submerged soil or soil from which water is freely seeping; or
- iv. Submerged rock that is not stable, or
- v. Material in a sloped, layered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

Excavations Made in Type B Soil

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

**SIMPLE SLOPE****Excavations Made in Type C Soil**

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.

**SIMPLE SLOPE**

URS Corporation
URS Corporation Health & Safety Program

SIMPLE SLOPES

MAXIMUM ALLOWABLE SLOPES
 SOIL OR ROCK TYPE
 MAXIMUM ALLOWABLE SLOPES (H:V)¹
 FOR
 EXCAVATIONS LESS THAN 20 FEET DEEP³

STABLE ROCK	VERTICAL (90 Deg.)
TYPE A ²	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

¹ Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

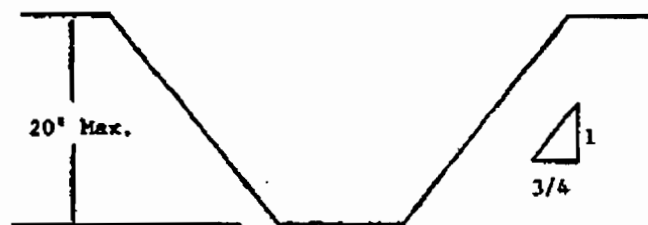
² A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53 degrees).

³ Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

Slope Configurations (All slopes stated below are in the horizontal to vertical ratio)

Excavations made in Type A soil.

All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.



SIMPLE SLOPE - GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1.



Health and Safety Program
**EXCAVATION / TRENCHING
AUTHORIZATION**

Attachment 13-3

POST AT LOCATION
(GOOD FOR ONE WEEK ONLY)

Authorization No. _____ Authorization From _____ To _____

Competent Person: _____

Project Name: _____ Project Location: _____

Description of Job or Special procedures: _____

Check Yes, No, or N/A
for Not Applicable

EMPLOYEE TRAINING AND PRE-EXCAVATION BRIEFING

1. Safe Excavation and Rescue Training Conducted on: _____ Date: _____			
2. Mandatory pre-excavation briefing conducted on: _____ Date: _____			
	Yes	No	N/A
3. Does this job require special training?	☐	☐	☐

ELECTRICAL SAFETY

	Yes	No	N/A
1. Are all electrical devices grounded, double insulated, or GFCI protected?	☐	☐	☐
2. Have all power cords and tools been visually inspected?	☐	☐	☐

SURFACE ENCUMBRANCES

1. Have all surface encumbrances that are located so as to create a hazard to employees been removed or supported, as necessary, to safeguard employees?	☐	☐	☐

UNDERGROUND INSTALLATIONS

1. Have the estimated locations of all underground installation been determined prior to excavation?	☐	☐	☐
2. Have utility companies been contacted and advised of proposed work?	☐	☐	☐
3. Are underground installations protected, supported or removed while excavations are open?	☐	☐	☐

PROTECTIVE SYSTEMS

1. Excavation slopes comply with Type C Soil Classification?	☐	☐	☐
2. If no to question 1, has soil been examined and been determined to be other than Type C soil by a Competent Person?	☐	☐	☐
3. If protective measures beyond sloping are required, do they meet OSHA Appendix standards?	☐	☐	☐



Health and Safety Program

**EXCAVATION / TRENCHING
AUTHORIZATION**

Attachment 13-3

	Yes	No	N/A
4. If no to question 3, has the protective system been designed and stamped by a Registered Professional Engineer?	☐	☐	☐

MEANS OF EGRESS FOR TRENCHES DEEPER THAN 4 FEET

1. Are stairways, ladders, or ramps provided every 25 feet?	☐	☐	☐

ACCESS AND EGRESS

1. Are structural ramps that are used solely by personnel as a means of access or egress from excavations designed by a competent person?	☐	☐	☐
2. Are ramps and runways constructed so structural members are connected to prevent displacement?	☐	☐	☐
3. Are structural ramps that are used for access and egress of equipment designed by a competent person qualified in structural design and constructed in accordance with the design?	☐	☐	☐
4. Are structural members used for ramps and runways of uniform thickness?	☐	☐	☐
5. Are cleats used in connecting runway structural members attached in a manner to prevent tripping?	☐	☐	☐
6. Are structural ramps used in lieu of steps provided with cleats or other surface treatment to prevent slipping?	☐	☐	☐

EXPOSURE TO VEHICULAR TRAFFIC

1. Are personnel exposed to public vehicular traffic wearing reflectorized or high visibility vests?	☐	☐	☐

EXPOSURE TO FALLING LOADS

1. Are employees prohibited from standing underneath loads handled by lifting or digging equipment?	☐	☐	☐
2. Are employees prohibited from standing next to vehicles being loaded or unloaded?	☐	☐	☐

WARNING SYSTEMS FOR MOBILE EQUIPMENT

1. Are warning systems such as barricades, hand or mechanical signals, or stop logs utilized when mobile equipment is operated adjacent to or at the edge of an excavation?	☐	☐	☐

TESTING FOR HAZARDOUS ATMOSPHERES

1. Are the atmospheric hazards that can be reasonably expected to exist in excavations greater than 4 feet deep tested and controlled?	☐	☐	☐
	READING:	TIME:	INITIAL:
2. Test of Oxygen Content:	_____ % O ₂ (19.5% Minimum)	_____	_____
3. Test for Flammable Concentrations:	_____ % LEL (10% Maximum)	_____	_____
4. Test for Toxic Concentration:	_____ %PPM of _____	_____	_____



Health and Safety Program

EXCAVATION / TRENCHING AUTHORIZATION

Attachment 13-3

	Yes	No	N/A
5. Is testing conducted as often as necessary to ensure safety personnel?	☐	☐	☐

EMERGENCY RESCUE EQUIPMENT

1. Is emergency rescue equipment such as SCBA, safety harness and line, or basket stretcher readily available and attended when hazardous atmospheric conditions exist?	☐	☐	☐
2. Are employees who enter bell-bottom pier holes or other similar deep and confining excavations wearing a body harness with a life-line?	☐	☐	☐

PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

1. Are employees prohibited from entering excavations that have accumulated water?	☐	☐	☐
2. Is water being controlled or prevented from accumulating in excavation by the use of water removal equipment?	☐	☐	☐
3. Is water control equipment operation being monitored by a competent person?	☐	☐	☐
4. Are diversion ditches, dikes, or other suitable means used to prevent surface water from entering excavation?	☐	☐	☐
5. Are excavations subjected to run-off from heavy rain immediately re-inspected by a competent person?	☐	☐	☐

PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

1. Is adequate protection provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face?	☐	☐	☐
2. Are employees protected from excavated or other material and equipment by placing this material a minimum of two (2) feet from the edge of excavations or by the use of retaining devices?	☐	☐	☐

STABILITY OF ADJACENT STRUCTURES

1. Are support systems such as shoring, bracing, or underpinning provided to ensure stability of adjoining structures (i.e., buildings, walls) endangered by excavation activities?	☐	☐	☐
2. Has any excavation below the level of the base or footing of foundations or retaining walls been:			
• Provided with a support system such as under pinning to ensure the safety of employees and stability of the structure?	☐	☐	☐
• Performed in stable rock?	☐	☐	☐
• Determined by a registered professional engineer that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity?	☐	☐	☐
• Determined by a registered professional that the excavation work will not pose a hazard to employees?	☐	☐	☐
3. Is the undermining of sidewalks and pavement structures prohibited?	☐	☐	☐

INSPECTIONS

1. Are daily inspections of excavations where employee exposure can be reasonably anticipated being done by the competent person?	☐	☐	☐
2. Are inspections being performed by a competent person after every rainstorm or other hazard increasing occurrence?	☐	☐	☐
3. Are employees removed from the excavation if the competent person finds evidence at any time of a situation that could result in a possible cave-in, protective system failure, hazardous atmosphere or other hazardous condition?	☐	☐	☐



Health and Safety Program
**EXCAVATION / TRENCHING
AUTHORIZATION**

Attachment 13-3

	Yes	No	N/A

FALL PROTECTION

1. Are standard guardrails provided on walkways and bridges that cross over excavations?	☐	☐	☐
2. Are all remotely located excavations adequately barricaded or covered?	☐	☐	☐
3. Are temporary wells, pits, shafts and similar exploratory operations backfilled upon completion?	☐	☐	☐

I have inspected the excavation described in this authorization:

Signature of Competent Person

Date



Health and Safety Program

DAILY EXCAVATION / TRENCH INSPECTION REPORT

Attachment 13-4

Competent Person: _____ Date: _____

Project Name: _____ Weather Conditions: _____

Project Location: _____ Rainfall Amounts
24 hours Previous: _____

"I hereby attest that the following conditions existed and that the following items were checked or reviewed during this inspection".

Check Yes, No or N/A for Not Applicable. If comment is required, circle the number and see Page 2.

		Yes	No	N/A
1.	Are barricades or covers in place and in good condition?	☐	☐	☐
2.	Have any tension cracks observed along top on any slopes?	☐	☐	☐
3.	Is excavated material at least 2' from the edge of the excavation.	☐	☐	☐
4.	Are slopes cut at design angle of repose?	☐	☐	☐
5.	Is any water seepage noted in trench walls or bottom?	☐	☐	☐
6.	Are pumps in place or available if needed?	☐	☐	☐
7.	Is bracing system installed in accordance with design?	☐	☐	☐
8.	Is there evidence of significant fracture planes in soil or rock?	☐	☐	☐
9.	Is there any evidence of caving or sloughing of soil since the last inspection?	☐	☐	☐
10.	Are there any zones of unusually weak soils or materials not anticipated?	☐	☐	☐
11.	Are there any noted dramatic dips or bedrock?	☐	☐	☐
12.	Are all short-term trench(s) covered within 24 hours?	☐	☐	☐
13.	Have non-compliance items been photographed?	☐	☐	☐
14.	Are hydraulic shores pumped to design pressure?	☐	☐	☐
15.	Is shoring being used secure?	☐	☐	☐
16.	Does plan include adequate safety factor for equipment being used?	☐	☐	☐
17.	Is traffic adequately away from trenching operation?	☐	☐	☐
18.	Are barricade up and secure?	☐	☐	☐
19.	Are there trees, boulders or other hazards in area?	☐	☐	☐
20.	Is vibration from equipment or traffic to close to trenching operation?	☐	☐	☐
21.	Are trench box(s) certified?	☐	☐	☐
22.	Are GFCI's used on ALL temporary electrical cords?	☐	☐	☐
23.	Is access and egress located every 25 feet?	☐	☐	☐
24.	Is hazardous testing done on a regular basis?	☐	☐	☐
25.	Has rescue procedure been established and is equipment immediately available?	☐	☐	☐



**DAILY EXCAVATION / TRENCH
INSPECTION REPORT**

Comments: Place question number in front of applicable comment.

URS Corporation

URS Corporation Health & Safety Program FIRE EXTINGUISHER PLACEMENT GUIDELINES

1. Fire Extinguishers – General

The following are **minimum** requirements for fire extinguisher placement in office buildings, construction facilities, support buildings, and/or buildings under construction. In some cases, client requirements may be more stringent, in which case the client's requirements supercede the guidelines below.

- a. A fire extinguisher, rated at a minimum of 2A, must be provided for each 3,000 square feet of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet.
- b. At least one fire extinguisher, rated at a minimum of 2A, must be provided on each floor. In multi-story buildings, at least one fire extinguisher must be located adjacent to the stairway.
- c. Where more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used, a fire extinguisher, rated at least 10B, must be provided within 50 feet.
- d. Portable fire extinguishing equipment, suitable for the fire hazard involved, must be provided at convenient, conspicuously accessible locations in Yard Storage areas. Portable fire extinguishers, rated at least 2A, shall be placed so that maximum travel distance to the nearest unit does not exceed 100 feet.

2. Flammable/Combustible Liquid Storage

The following are **minimum** requirements for fire extinguisher placement in flammable/combustible liquid and gas storage areas. In some cases, client requirements may be more stringent, in which case the client requirements supercede the guidelines below. Refer to SMS 15, "Flammable and Combustible Liquids and Gases, Attachment 2".

- a. At least one portable fire extinguisher, rated at least 20B, must be located outside of, but not more than 10 feet from, the door opening into any room used for storage of more than 60 gallons of flammable or combustible liquids.
- b. At least one portable fire extinguisher, rated at least 20B, must be located not less than 25 feet, nor more than 75 feet, from any flammable

liquid storage area located outside.

- c. At least one portable fire extinguisher, rated at least 20BC, must be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable/combustible liquids.
- d. At least one fire extinguisher, rated at least 20BC, must be provided within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication/service areas.
- e. At least one fire extinguisher, rated at least 20BC, must be provided at each LPG container storage area.

3. Hot Work

A minimum of one fire extinguisher, rated at least 20BC, must be provided for each hot work location. The extinguisher should be conspicuously positioned no more than 10 feet from the hot work. Refer to SMS 20, "Hot Work".



Health and Safety Program

**FLAMMABLE AND COMBUSTIBLE
LIQUID CLASSIFICATIONS**

Attachment 15-1

Flammable Liquid	Flash Point	Boiling Point
Class 1A	< 73° F	< 100° F
Class 1B	< 73° F	> 100° F
Class 1C	> 73° F < 100° F	
Combustible Liquid		
Class 2	> 100° F < 140° F	
Class 3	≥ 140° F	

Maximum Allowable Size of Containers and Portable Tanks

Container Type	Flammable Liquids			Combustible Liquids	
	Class 1A	Class 1B	Class 1C	Class II	Class III
Glass or approved plastic	1 pt	1 qt	1 gal	1 gal	1 gal
Metal (other than DOT drums)	1 gal	5 gal	5 gal	5 gal	5 gal
Safety cans	2 gal	5 gal	5 gal	5 gal	5 gal
Metal drums (DOT specifications)	60	60	60	60	60
Approved portable tanks	660 gal	660 gal	660 gal	660 gal	660 gal

Maximum Storage in Buildings Outside of Storage Cabinet or Storage Room

Type	Amount
Class 1A	25 gallons
Class 1B (containerized)	120 gallons
Class 1B (single portable tank)	660 gallons
Class 1C (Containerized)	120 gallons
Class 1C (single portable tank)	660 gallons
Class 2 (containerized)	120 gallons



Health and Safety Program

Attachment 15-2

FLAMMABLE, COMBUSTIBLE, OXIDIZER & COMPRESSED GAS INSPECTION CHECKLIST

Location Inspected: _____ Job No.: _____

Date Inspected: _____ Name of Inspector: _____

		Yes	No	N/A
Storage Cabinets				
1.	Flammable cabinets do not obstruct room exits.			
2.	No more than 60 gallons of flammable or 120 gallons of combustible liquid is stored in a cabinet.			
3.	No more than three cabinets are located in a storage area.			
4.	Metal storage cabinets have self-closing doors.			
5.	Cabinets are labeled "FLAMMABLE-KEEP FIRE AWAY"			
Safety Cans				
6.	Safety cans are constructed of stainless steel, Monel or tin.			
7.	Safety cans have a flame arrestor and spring-loaded cap on both the filling and pouring spouts.			
Drum & Drum Storage Areas				
8.	Drums are stored in a vertical position.			
9.	Bungs are closed when liquid is not being transferred.			
10.	Drums are shielded from the sun.			
11.	Funnels with installed flash arrestor are used when transferring flammable liquids into drums.			
12.	A minimum distance of 25 feet between a drum storage area and buildings is present.			
13.	A "NO SMOKING" sign is posted in the area.			
14.	An emergency spill kit is near the drum storage area.			
15.	A 20 lb. Dry-chemical fire extinguisher is no less than 10 feet or more than 50 feet from the storage area.			
Waste Cans				
16.	Combustible scrap, debris and waste materials (oily rags, etc.) are stored in covered metal cans.			
17.	Waste cans are removed from the work area daily.			
18.	Waste cans have spring-loaded self-closing lids.			
Storage Rooms Designed Specifically For Flammable				
19.	Room construction meets NFPA fire-resistance requirements.			
20.	Rooms with automatic extinguishing systems have the following:			



Health and Safety Program

Attachment 15-2

FLAMMABLE, COMBUSTIBLE, OXIDIZER &
COMPRESSED GAS INSPECTION CHECKLIST

		Yes	No	N/A
	Noncombustible liquid-tight raised sills or ramps at least 4 inches in height.			
	Flooring at least four inches below the surrounding floor, or an open grated trench that drains to a safe location.			
	Openings with approved self-closing fire doors.			
	Liquid-tight construction where the walls join the floors.			
	Shelving, racks, dunnage floor overlay and other interiors with one inch wood.			
21.	Rooms are ventilated by a gravity or mechanical exhaust system that:			
	Commences not more than 12 inches above the floor.			
	Is designed to provide for a complete change of air within the room at least six times per hour.			
	Is controlled by a switch located outside the door, with ventilating equipment and any light fixtures operated from the same switch.			
Flammable & Combustible Storage Areas Within Buildings				
22.	At least one portable fire extinguisher rated not less than 20-B is located outside of but not more than ten feet from the door opening into any room used for the storage of more than sixty gallons of flammable or combustible liquids.			
23.	Buildings or rooms are locked when not occupied.			
24.	Exits, stairways or passageways are not used for storing flammables and combustibles.			
25.	No more than 25 gallons of Class IA or 60 gallons of Class IB; II or III liquids is located in a room outside of a flammable storage locker or flammable storeroom.			
26.	An aisle at least three feet wide is maintained in storage areas.			
27.	No more than those amounts needed for one day's use are stored in buildings under construction.			
Outside Storage of Flammable and Combustible Liquids				
28.	At least one portable fire extinguisher having a rating of not less than 20-B is located not less than twenty-five feet or more than 75 feet from any outside flammable liquid storage area.			
29.	For containers not more than 60 gallons each, no more than 1,100 gallons in any one group are stored.			
30.	Groups of containers are separated by five-foot clearances.			
31.	Groups of containers are more than fifty feet from buildings.			
32.	Portable tanks (not exceeding 660 gallons in capacity) are provided with emergency venting devices as specified by NFPA 30.			
33.	Storage areas are free of accumulation of weeds, debris, and other combustible materials not necessary to the storage.			



Health and Safety Program

Attachment 15-2

FLAMMABLE, COMBUSTIBLE, OXIDIZER & COMPRESSED GAS INSPECTION CHECKLIST

		Yes	No	N/A
Storage Tanks				
34.	Tanks have relief vents.			
35.	Tank vents are not close to open flames, stacks, heating apparatus, or any other source of ignition.			
36.	A dike or curb or other suitable means to prevent the spread of leakage from tanks.			
37.	Diked areas have a capacity equal in volume to at least that of the largest tank plus 10% of all other tanks in the enclosure.			
38.	Provisions to drain off accumulations of ground or rainwater or spills in diked areas.			
Dispensing of Flammable and Combustible Liquids				
39.	Dispensing outlets for above ground tanks with nationally listed automatic-closing valve, without a latch-open device.			
40.	Dispensing Systems are electrically bonded and grounded.			
41.	Tanks, hoses and containers of five gallons or less in metallic contact while transferring flammable liquids.			
42.	Electrically bonded systems are used for transferring flammable liquids in containers in excess of five gallons.			
43.	Closed piping systems are used for drawing flammable liquids during transfer.			
44.	Flammables and combustibles are drawn from a container or portable tank by use of gravity or through a pump using an approved self-closing valve.			
Liquefied Petroleum Gas – Refueling				
45.	Equipment is shut down during refueling operations.			
46.	Leather gloves and safety glasses are worn during refueling operations.			
47.	Smoking and hot work is prohibited during refueling.			
48.	Refueling occurs at least 25 feet from buildings.			
Compressed Gases - Storage				
49.	Cylinders must be capped when regulators are removed.			
50.	Oxygen and fuel cylinders are stowed in designated well-ventilated areas.			
51.	Storage areas have temperatures less than 130 degrees.			
52.	Cylinders are stored upright and secured from falling over.			
53.	Cylinders are in segregated groups by gas type and not intermingled with other cylinders.			
54.	Oxygen cylinders are stored at least 20 feet away from flammables. (A fire resistive partition of at least 1-hour fire resistance rating of at least 5-foot height may also be used.)			
55.	Flammable or combustible materials are kept at least 20 feet away from stored cylinders.			



Health and Safety Program

Attachment 15-2

FLAMMABLE, COMBUSTIBLE, OXIDIZER & COMPRESSED GAS INSPECTION CHECKLIST

		Yes	No	N/A
56.	Gas cylinder valves are protected from snow and ice during winter months.			
57.	Oxygen cylinders are kept free from oil and grease.			
58.	Welding cylinders are securely fastened to ready-use racks.			
59.	Smoking or open flames are not permitted in areas where cylinders are stored.			
60.	Cylinder storage areas are posted with the following sign: "DANGER – NO SMOKING OR OPEN FLAME"			
61.	Cylinders are labeled with gas contents and warning statement.			
62.	Empty cylinders are segregated from full cylinders.			
Oxidizers				
63.	Oxidizers are stored separately from flammables.			
64.	When oxidizers are shifted to a second container, the container is labeled with the appropriate warning labels.			
65.	Secondary containers are compatible with oxidizers.			
66.	Oxidizers are stored away from heat sources where the maximum temperature exceeds 100 degrees F.			
67.	Chromic acid, nitric acid, perchloric acid, potassium permanganate (all oxidizers) are stored separately from other corrosives and flammables.			

URS Corporation
URS Corporation Health and Safety Program

INITIAL WORK/MONITORING CYCLES

ADJUSTED TEMPERATURE	NORMAL WORK CLOTHES	PROTECTIVE CLOTHING
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

URS Corporation

**URS Corporation Health & Safety Program
EMPLOYEE HEAT STRESS EXPOSURE MONITORING RECORD**

DATE: _____ SAFETY REPRESENTATIVE: _____

WORKER'S NAME: _____ SUBCONTRACTOR: _____

WORK ACTIVITY: _____

<i>Time (24 hour)</i>	<i>Oral Temp (°F)</i>	<i>Pulse (BPM)</i>	<i>Comments</i>

DATE: _____ SAFETY REPRESENTATIVE: _____

WORKER'S NAME: _____ SUBCONTRACTOR: _____

WORK ACTIVITY: _____

<i>Time (24 hour)</i>	<i>Oral Temp (°F)</i>	<i>Pulse (BPM)</i>	<i>Comments</i>

DATE: _____ SAFETY REPRESENTATIVE: _____

WORKER'S NAME: _____ SUBCONTRACTOR: _____

WORK ACTIVITY: _____

<i>Time (24 hour)</i>	<i>Oral Temp (°F)</i>	<i>Pulse (BPM)</i>	<i>Comments</i>

URS Corporation

HEAT STRESS INFORMATIONAL SUPPLEMENT

SIGNS, SYMPTOMS AND FIRST AID

Heat rash (prickly heat) may result from continuous exposure to heat or humid air. It appears as red papules (elevated skin lesion), usually in areas where the clothing is restrictive, and gives rise to a prickly sensation, particularly as sweating increases. It occurs in skin that is persistently wetted by unevaporated sweat. The papules may become infected unless treated.

First Aid for Heat Rash - to prevent heat rash: shower after work, dry off thoroughly, and put on clean, dry underwear and clothes. Try to stay in a cool place after work. If, in spite of this, you develop heat rash, see your physician.

Heat Cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:

- Muscle spasms.
- Pain in the hands, feet and abdomen.

First Aid for Heat Cramps - leave the work area, and rest in a cool, shaded place. Drink one or two glasses of electrolyte replacement drink, and try to gently massage the cramped muscle. Once the spasms disappear, you may return to work; taking adequate breaks and drinking electrolyte replacement drink should prevent the cramps from returning.

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

- Pale, cool, moist skin.
- Heavy sweating.
- Dizziness.
- Nausea.
- Fainting.

The key here is that the victim is still sweating, so the cooling system is still working; it's just under severe stress. The body core temperature may be elevated. It is important to recognize and treat these symptoms as soon as possible, as the transition from heat exhaustion to the very hazardous heat stroke can be quite rapid.

First Aid for Heat Exhaustion - leave the work area immediately, go through decon and remove all chemical protective clothing. Rest in a cool, shaded place and open your clothing to allow air circulation; lay flat except when taking fluids. Drink plenty of cooled electrolyte replacement drinks. Your work is over for the day; do not attempt to return. Medical assistance in severe cases may be warranted.

Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:

- Red, hot, usually dry skin.
- Lack of or reduced perspiration (lack of perspiration may be masked for those wearing chemical protective clothing since perspiration from earlier in the day will be present).
- Nausea.
- Dizziness and confusion.
- Strong, rapid pulse.
- Coma.

First Aid for Heat Stroke - THIS IS A MEDICAL EMERGENCY! SUMMON MEDICAL ASSISTANCE IMMEDIATELY! Remove the victim from the work area, perform a gross decon, and remove all PPE. Have the victim lie down in a cool, shady area. Attempt to bring the victim's temperature down by increasing air movement (electric fan) or placing wetted sheets or towels on them. Place an ice bag on the victim's head. The victim must not be sent home or left unattended without a physician's specific order.

HEAT STRESS PREVENTION

The best approach to avoiding heat-related illnesses is through preventative heat stress management. The site manager and site safety officer are responsible for implementing this program.

Rest areas - a relatively cool, shaded area must be provided for breaks when ambient temperatures exceed 70°F and workers are wearing chemical protective clothing (including uncoated Tyvek), or if temperatures exceed 90°F and workers are wearing "Level D" coveralls or work clothes. A car or van is an oven, not a rest area. For Hazardous Waste Sites, the rest area should be *located in the support zone adjacent to the contamination reduction zone*, situated so that part of it is in the decon area so workers can take breaks without going through full decon. If shade is not available, build some: use a plastic "dining canopy", which can be obtained at sporting goods stores. This same type of canopy can be set up to shade personnel performing various types of work in hot weather.

Liquids - encourage employees to drink plenty of cool plain water and electrolyte replacement drinks. Supplementing water with cool electrolyte replacement drinks, such as Gatorade, Squench or Quik-kick (drink) is helpful to employees who tend to sweat a lot. Do not use "community cups"; use paper cups. Have workers drink 16 ounces of drink before beginning work, such as in the morning and after lunch. At each break, workers should take 8-16 ounces of drink. Don't wait until you are thirsty to drink.

Discourage the use of alcohol during non-working hours, and discourage the intake of coffee during work hours, as these make heat stress control more difficult.

Acclimatization - this is the process by which your body "gets used to" hot work environments. This is achieved by slowly increasing workloads. Start at 50 percent capacity on day one, and increase by 10 percent per day; on day six, you'll be at 100 percent. You don't lose acclimatization over a weekend, but it'll start to decrease after three to four days. If you don't do hot work for a week, it is gone. You don't have to do full shift hot work to achieve or retain acclimatization; a minimum of 100 minutes of continuous hot work exposure per day is adequate.

Auxiliary Cooling - auxiliary cooling is usually obtained by providing workers with a specially-designed vest, which is worn under the protective clothing, but over any underclothing. These vests typically provide cooling via one of two methods: the use of ice or other frozen media, or the use of a vortex cooler. Each method has its advantages and disadvantages.

The frozen media vest requires a means for freezing the media, and the media (usually water or "blue ice") will melt, requiring replacement.

The vortex cooler tends to cool more uniformly. Instead of frozen media, this vest uses the expansion of compressed air to cool the wearer. The drawback is the compressed air requirement, but this is negated when the wearer is already using an airline respirator supplied by a compressor. A vortex cooler should not be supplied from air cylinders, as this will draw down the cylinders rapidly.

Auxiliary cooling should be considered when the following conditions exist:

- Ambient temperature over 80°F
- Workers wearing impermeable garments (PE Tyvek, Saranex, Chemrel, etc.)
- It is desirable to have long work shifts with minimum interruption

URS Corporation**DAILY HEAVY EQUIPMENT SAFETY INSPECTION CHECKLIST**

EQUIPMENT ID NO.: _____

DATE: _____

EQUIPMENT NAME: _____

INSPECTOR'S NAME: _____

BEG HOURS: _____ END HOURS: _____

EMPLOYEE NO.: _____

ITEM INSPECTED	CHECK IF SATISFACTORY	COMMENTS
Falling Object Protective Structure (FOP)		
Roll-Over Protection Structure (ROP)		
Seat Belts		
Operator Seat Bar(s)		
Side Shields, Screens or Cab		
Lift Arm Device		
Grab Handles		
Back-up Alarm - Working		
Lights		
Guards		
Horn		
Anti-Skid Tread Clear of Mud		
Safety Signs; i.e., counterbalance swing area		
Fire Extinguisher		
General Condition		
Fuel Connection		
Oil (fuel and no leaks)		
Clear of Extra Materials		
Controls Function Properly		
Damaged Parts		
Hydraulic System (full and no leaks)		
Parking Brake		
Lift Arm and Bucket		
Tires/Tracks		
Steering		
Breathing Air System		
Blast Shields		
Operator Signature: _____		
Gallons of Fuel Added		
Quarts of Oil Added		

INSTRUCTIONS: Each shift inspect all applicable items indicated. If an unsatisfactory condition is observed, suspend operation of the equipment and report the unsatisfactory condition to the site supervisor immediately.

URS Corporation

SANITATION INSPECTION SHEET

Location: _____

Job No: _____

Date Inspected: _____ Name of Inspector: _____

Note: All "No" notations must be corrected

		Yes	No
Toilets			
1.	Are there an adequate number of toilets on site? 1 - 15 employees = 1 toilet 16 - 35 employees = 2 toilets 36 - 55 employees = 3 toilets 56 - 80 employees = 4 toilets 81 - 110 employees = 5 toilets		
2.	Toilets are in clean condition.		
3.	Toilet paper is provided.		
4.	Toilet areas are clean and sanitary.		
Hand Washing Facilities			
5.	Hand washing facilities are provided near toilets.		
6.	Paper towels and soap are provided.		
Drinking Water			
7.	Drinking water is provided on site.		
8.	Disposable cups are provided or fountain type dispenser is provided.		
9.	Drinking water containers are kept clean and tightly closed or covered.		
Lunch Rooms			
10.	Lunch rooms or eating areas are kept clean.		
11.	Microwaves are used for food only.		
12.	Microwave ovens are kept clean.		
13.	Refrigerators are kept clean.		
14.	Refrigerators are used to store food only.		
Vermin			
15.	Rats, mice and other vermin are not living within buildings.		
16.	Cockroaches and fleas are not thriving within buildings.		

REMARKS

URS Corporation
URS Corporation Health & Safety Program
TRAFFIC CONTROL INSPECTION CHECKLIST

Project Name: _____ Project Number: _____

Item	Yes	No	How Many?
1. Are any devices missing?			
Do any devices need repair?			
Were all replaced or repaired?			
2. Are any lights(flashers, etc.) not functioning?			
Were they all replaced or repaired?			
3. Are any devices improperly placed?			
Were all positions corrected?			
4. Do any devices need cleaning?			
Were all devices cleaned?			
Additional comments:			

The above check was completed by: _____
(name/title)

on _____ at _____ ☐ a.m. ☐ p.m.
(date) (time)

URS Corporation
URS Corporation Health & Safety Program
IDENTIFYING WHEN A RESPIRATOR IS NEEDED

Site Location: _____ Date: _____

Name of Person Performing Evaluation: _____

Project: _____

Answer the questions below for the jobs you are to perform on site. If a "yes" response is checked, consult with a URS Corporation Health and Safety Professional to determine:

- *if a respirator is truly needed for the job, as well as,*
- *the type of respirator needed for the job.*

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
<i>Abrasive Blasting</i> • Abrasive blasting (with any type of grit or material) will be performed. • Employee will fill abrasive blasting pots or perform clean-up activities. • Employee will be in a contained area where abrasive blasting is taking place.			
<i>Acids</i> • Liquid or powder acids will be used in a situation where acid vapors, mists or dust may be breathed.			
<i>Adhesives</i> • Aerosol-propelled adhesives are to be used in areas where there is no or insufficient local exhaust ventilation. • Two-part adhesives (mix part one with two, let set then use) are to be used in areas where there is limited ventilation.			
<i>Alkalis/Bases/Caustics</i> • Powdered alkalis will be used in a situation where an airborne dust may be breathed.			
<i>Asbestos Abatement</i> • Asbestos will be removed, repaired or sampled. • Employees will be inspecting or overseeing areas where asbestos will be removed or disturbed.			

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
<i>Cleaning Compounds</i> - Degreasers or carbon removers will be used in areas where local exhaust ventilation is not provided. - Aerosol propelled cleaning compounds will be used in areas where there is no local exhaust ventilation. - Degreasers or carbon removers will be used in voids, tanks, or other confined spaces.			
<i>Corrosion Preventive Compounds</i> Corrosion prevention compounds, including chemical conversion compounds and corrosion inhibitors, will be used in areas where there is no local exhaust ventilation.			
<i>Detergents/Soaps</i> - Ammonia based detergents will be used in large quantity (more than five gallons) in areas where local exhaust ventilation cannot be provided. - Large quantities (5 or 55 gallon containers) of high pH powder detergent/soap will be used in a situation where dust may be breathed.			
<i>Fuels</i> (including regular or unleaded gasoline, kerosene, diesel fuel, JP-5) Employees will be inside unventilated fuel cells or other confined spaces containing fuels.			
<i>Grinding, Cutting, Sanding</i> - Cutting, grinding or sanding surfaces that have coatings containing lead, cadmium, chromium, zinc or beryllium. - Cutting, grinding or sanding surfaces that are concrete or glass without use of ventilation or water.			
<i>Hazardous Waste Sites</i> - Employees will be performing tasks on a hazardous waste site that requires the use of respirator (as indicated in the site safety & health plan). - Employees will be performing site assessments on potential hazardous waste sites.			
<i>Hydraulic Fluids</i> (including petroleum-based fluids, synthetic fire-resistant fluids, and water based fire resistant fluids) - Hydraulic fluids and the vapors generated will not be exhausted using local exhaust ventilation. - Synthetic fire-resistant fluids or water-based fire-resistant fluids will be used in an area where the air is contaminated with visible mist or spray from hydraulic fluids.			

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
Inspection Penetrants (including Fluoro-finder, water indicating pastes, and penetrant removers) An aerosol-propelled inspection penetrant will be used in an area where local exhaust ventilation cannot be provided, or in a situation where the solvent vapors can be breathed.			
Lead Abatement Activities - Lead containing materials will be disturbed, removed or sampled. - Employees will be inspecting or overseeing areas where lead will be removed or disturbed.			
Lubricants/Oils Aerosol lubricants/oils will be sprayed with no immediate exhaust ventilation.			
Oxidizers (materials that give off oxygen including chlorine laundry bleach, calcium hypochlorite, calcium oxide, oxygen candles, lithium hydroxide, hydrogen peroxide, and sodium dichromate) - Oxidizers containing organic chlorine will be used in a situation where the dusts/vapors may be breathed. - Powdered oxidizers will be used in a situation where airborne dust may be breathed.			
Paint Materials (including paints, primers, thinners, enamels, lacquers, strippers, coatings and varnishes) - Paint materials will be spray applied in areas where there is no local exhaust ventilation. - Two part (mix part a with part b, let set, then apply) polyurethane or epoxy polyamide paints will be brush or spray applied. - Paints containing lead, chromium, cadmium, beryllium, and zinc (refer to the MSDS). - Paint materials will be applied in confined spaces.			
Solvents (including hydrocarbon solvents such as acetone, methyl ethyl ketone, toluene, xylene, and alcohols, as well as mixed solutions like antifreeze, heat transfer fluid, turpene, dope and naphtha thinner) - Local exhaust ventilation will not be provided and work will involve breathing solvent vapors. - Solvents will be used within confined spaces. - Solvents will be applied using aerosols.			
Thermal Insulation (including asbestos & non-asbestos materials like pipe lagging, fiberglass insulation, boiler insulation, packing materials and floor/ceiling tiles) Insulation will be disturbed, removed or sampled.			

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
Water Treatment Chemicals (includes corrosive chemicals such as tri-sodium phosphate, hardness buffer, titrating solution, morpholine, caustic soda, citric acid and nitric acid as well as toxic chemicals such as mercuric nitrate, hydrazine, EDTA and sodium nitrate) • Morpholine, EDTA, or harness buffer/titrating solution is to be used in poorly ventilated spaces. • Powdered water treatment chemicals will be used in a situation where chemical dusts may be breathed.			
Welding/Brazing • Welding will be performed in confined spaces. • Welding galvanized metal or stainless steel. • Brazing with cadmium or lead.			
For Any of The Above Listed Activities • A employee will be in the immediate area - within 10 feet of the job or operation, or • Employee will be inside confined space where activities are taking place, or • Employee will be inside a "controlled area" such as found in asbestos abatement, lead abatement, radiation control area, or a hazardous waste site.			
Material Safety Data Sheets • For any chemical product used, a respirator is recommended.			
Product Labels • For any chemical or process that indicates respirators should be used.			
Product Use Instructions For any product used, instructions indicate a respirator should be used.			
Standard Operating Procedures A Standard Operating Procedure indicates the use of a respirator.			

URS Corporation**URS Corporation Health & Safety Program
VOLUNTARY USE OF RESPIRATORS**

Instructions: Have the employee that is opting to use a respirator for non-overexposure conditions read this page, then sign on the bottom of the page. Forward a copy of the signed form to the Regional Training Records Administrator, and maintain a copy in the employee's personnel file.

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for employees. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the employee. Sometimes employees may wear respirators to avoid exposures to hazards, even if the amount of the hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your own voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not pose a hazard.

You should do the following:

1. Read and follow all instructions provided by the manufacture on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety & Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect you against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, fumes, smoke or very small solid particles.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.
5. If you have any health conditions (asthma; high blood pressure; emphysema; heart disease) that could be aggravated by using a respirator, you should check with your doctor before using one.

I have read and understand this information on: _____ (date)

Employee's name: _____

Employee's signature: _____

URS Corporation

URS Corporation Health & Safety Program RESPIRATOR STANDARD OPERATING PROCEDURE

Job Task Reviewed: _____

Date Reviewed: _____

Task Reviewed by: _____

ADMINISTRATIVE PROCEDURES

1. All respirator users must be medically qualified to use respirators. Point of contact for scheduling is the Regional Medical Surveillance Administrator.
2. Respirator users must be trained annually in respirator use and fit tested annually.
3. Respirator will be used only by the person to whom it was issued.
4. Persons using glasses who are required to use a full-face respirator may use contact lenses or eyeglass inserts designed for the respirator.

GUIDANCE FOR SELECTION OF RESPIRATOR & CARTRIDGES/FILTERS

1. _____ respirators are currently being issued and used for the following job activity: _____
2. The respirator will be equipped with the following cartridges/filters: _____
3. Filters are to be changed when the breathing resistance increases.
4. Cartridges are to be changed: _____ or when the contaminant you are protecting yourself from can be smelled or tasted.

FIT TESTING & FIT CHECKING

1. Fit testing is required annually. To arrange for fit testing call your local safety representative.
2. Respirator users will "fit check" the respirator every time the respirator is put on:
 - **Negative Check** - cover filters/cartridges with palms of hands and breath in, leakage should not be detected around the face seal of the respirator. Do not use if leakage is detected.
 - **Positive Check** - cover the exhalation valve cover with palm of hand and blow out slightly, leakage should not be detected around the respirator seal.
 - **For Air Supply Respirators** - kink or close off air supply hose and breath in, leakage should not be detected around the face seal of the respirator.

CLEANING & MAINTENANCE OF RESPIRATOR

1. Clean and disinfect respirator after every use.
2. Inspect respirator after every day in use to ensure parts are not missing. Replace missing parts from stock supply.
3. Store clean respirator in labeled plastic bag out of direct sunlight.
4. Do not alter respirator in any way.

URS Corporation**URS Corporation Health & Safety Program
RESPIRATOR CARTRIDGE CHANGE SCHEDULE**

A cartridge change schedule must be developed for cartridges or canisters used with air purifying respirators that do not have an End of Service Life Indicator (ESLI). The purpose of this is to prevent contaminants from breaking through the respirator's sorbent cartridge(s), and thereby over-exposing employees. NIOSH has approved ESLIs for only four cartridges or canisters (mercury vapor, carbon monoxide, ethylene oxide, and hydrogen sulfide). Historically we have relied on the warning properties (odor, irritation) of a contaminant to dictate cartridge change. OSHA no longer allows this as the sole basis for changing respirator cartridges. In developing a change schedule the following factors should be considered:

- Contaminants.
- Concentration.
- Frequency of use (continuously or intermittently throughout the shift).
- Temperature and humidity.
- Work rate.
- The presence of potentially interfering chemicals.

The worst case conditions should be assumed to avoid early breakthrough. This must be documented in the project health and safety plan or, in the cases of office or labs, in the site specific Respiratory Protection Program.

Sources of Help**Manufacturers**

3M has an interactive "Cartridge Service Life" program that can be downloaded for free (<http://www.mmm.com/market/safety/ches2/index.html>)

This program will estimate cartridge service life for 3M products against many contaminants. The program does not evaluate the service life against mixtures (multiple contaminants). Because of the complexity in evaluating mixtures, OSHA offers the following guidance:

- When the individual compounds in the mixture have similar breakthrough times (i.e., within one order of magnitude), service life of the cartridge should be established assuming the mixture stream behaves as a pure system of the most rapidly migrating component with the shortest breakthrough time (i.e., sum up the concentration of the components).
- Where the individual compounds in the mixture vary by 2 orders of magnitude or greater, the service life may be based on the contaminant with the shortest breakthrough time.

Rule of Thumb (*"The Occupational Environment - Its Evaluation and Control"*)

- If the chemical's boiling point is $>70^{\circ}\text{C}$ and the concentration is less than 200 ppm you can expect a service life of 8 hours at a normal work rate.
- Service life is inversely proportional to work rate.
- Reducing concentration by a factor of 10 will increase service life by a factor of 5.
- Humidity above 85% will reduce service life by 50 %.

OSHA Interpretation

The OSHA inspection procedures for the respiratory protection standard specifies that where contaminant migration is possible, respirator cartridges/canisters should be changed after each work shift where exposure occurs unless there is objective data to the contrary (desorption studies) showing the performance in the conditions and schedule of use/non-use found in the workplace.

Respiratory Fit Test Record

Attachment 42-5

Name: _____

Social Security No: _____

Company/Office: _____

Last Medical Exam: _____

Fit Test Date: _____

Corrective Lenses Needed: Yes ☐ No ☐

Briefed on fundamental principles of respiratory protection, use, selection, inspection cleaning, maintenance and storage of equipment. Yes ☐ No ☐

Isoamyl acetate odor recognition Yes ☐ No ☐

	<u>RESPIRATOR 1</u>	<u>RESPIRATOR 2</u>	<u>RESPIRATOR 3</u>
Equipment Type	_____	_____	_____
Manufacturer's Name	_____	_____	_____
Model	_____	_____	_____
Size	_____	_____	_____
Facepiece Composition (Rubber/Silicone)	_____	_____	_____

<u>TEST PERFORMED</u>	<u>RESPIRATOR 1</u>	<u>RESPIRATOR 2</u>	<u>RESPIRATOR 3</u>
Negative Pressure Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐
Positive Pressure Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐
Isoamyl Acetate Vapor Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐
Irritant Smoke Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐

This qualitative fit test protocol has been adapted from OSHA Respiratory Protection Standard 29 CFR 1910.134, Appendix A.

Examiner's Name (Please Print)

Examiner's Signature

Date

Employee's Signature

Date

URS

URS Corporation**URS Corporation Health & Safety Program
INDUSTRIAL HYGIENE MONITORING FORM** **Project Information**

Name	Date / /
Social Security #	
Project Number	
Project Name and Location	
Weather Conditions	

Sample type	Personal ☐ Area ☐	URS Control Number:
Sample location:		Pump Manufacturer:
Sample media:		Pump Model Number:
Lot Number:		Pump Serial Number:
Contaminant sampled:		Analytical Method:

Sample Information

Sample I.D. Number	Sample Location	Pump Number	Flow Rate	Start Time	Stop Time	Elapsed Time (mins)	Volume (liters)

PPE Used

Corresponding Photographs

Sample I.D. Number	Photo Number, Roll No., Exposure No.	DESCRIPTION

 Site Activities Description/Comments:
 (Continue on reverse side if necessary)



Health and Safety Program
**SUBCONTRACTOR SAFETY
EVALUATION FORM**

Attachment 46-1

Revised: 5/9/01

It is the policy of URS to provide a safe and healthful environment for all of its employees through the prevention of occupational injuries and illnesses. As such, URS considers safety as paramount and requests the following information of all subcontractors.

Company Name	
Company Address	
Submitted By	
Title	
Phone	
Fax	
Type of services performed	
Standard Industrial Classification (SIC) Code	
Number of employees in company	
Date of submittal	

SAFETY PERFORMANCE DATA

1. Has your company performed work as a subcontractor to URS previously? ☐ Yes ☐ No

If yes, explain the nature of the work, project location and project date, URS Project Manager and telephone number.





Health and Safety Program
**SUBCONTRACTOR SAFETY
EVALUATION FORM**

Attachment 46-1

Revised: 5/9/01

	YEAR	YEAR	YEAR
PROVIDE THE FOLLOWING INFORMATION:			
E. Total hours worked			
F. OSHA Total Recordable Incident Rate ²			
G. OSHA Lost Workday Case Incident Rate ³			

4. Describe any workplace safety regulatory agency (e.g. OSHA) citation and violation the Company has received in the past three years. Explain the nature of the citation, classification, and final fine. Describe the resolution of any serious violations. Please feel free to attach separate statements where more space is required.

Year

Number of Citations

Final Fine Amount

Citation Statement

Year

Number of Citations

Final Fine Amount

Citation Statement

² Incident Rate (Item F) = $\frac{\text{Total Cases (Item D)} \times 200,000}{\text{Total hours worked (Item E)}}$

³ Lost Workday Case Incident rate = $\frac{\text{Total Lost Workday Cases (Item B)} \times 200,000}{\text{Total hours worked (Item E)}}$



Health and Safety Program
**SUBCONTRACTOR SAFETY
EVALUATION FORM**

Attachment 46-1

Revised: 5/9/01

5. Has your company received any Willful violations? ☐ Yes ☐ No
6. Does your company maintain a written Health and Safety program?
If yes please include a copy of the Table of Contents. ☐ Yes ☐ No
7. Does your firm have a safety officer? ☐ Yes ☐ No
If yes, please provide name and telephone number

Name

Telephone

8. Is your company capable of preparing safety procedures specific to the work proposed for this project? ☐ Yes ☐ No

RISK MANAGEMENT / INSURANCE DATA

1. Does your firm have insurance coverage for commercial liability and automobile liability without limits of at least \$1,000,000?
(Note that certain URS client contracts require insurance in excess of the levels noted above. Inability to supply insurance at levels required by URS' client contract could result in disqualification.) ☐ Yes ☐ No
2. Are you able to provide URS with insurance certificates naming URS and if requested, URS' client as an additional insured? ☐ Yes ☐ No
3. Please provide proof of current Worker's Compensation and Employers Liability Insurance coverage (attach certificate).



Health and Safety Program
**SUBCONTRACTOR SAFETY
EVALUATION FORM**

Attachment 46-1

Revised: 5/9/01

VERIFICATION OF DATA

Please have an officer of the Company sign below certifying that the information provided in this document is current and correct.

Name

Title

Signature _____

Date _____

Misrepresentation of data requested is grounds for immediate termination of contracts and disqualification from future consideration.

URS Use Only

Date Received: _____

Evaluated by: _____
Project Manager

Referrals only required as per Attachment 2

Submitted to Health and Safety Rep for evaluation: H&S Rep _____

Pass

Fail

Submitted to Counsel for evaluation: Counsel _____

Pass

Fail

Final Evaluation

Pass

Fail

Project Manager: _____

Signature: _____

Date: _____

**SUBCONTRACTOR
EVALUATION CRITERIA**

Prior to engaging a subcontractor on a project, Project Managers are strongly recommended to ensure that the contractor has an effective safety program, is capable of conducting its operations in a safe manner and has appropriate insurance coverage. The following guidelines shall be followed in determining whether the subcontractor may be used on a URS Corporation project.

GENERAL INFORMATION

The contractor must be able to complete the header section on Page 1 of the questionnaire including their Standard Industrial Classification. For assistance determining the SIC for a business refer to the Standard Industrial Classification Manual online at <http://www.osha.gov/oshstats/sicser.html>.

SAFETY PERFORMANCE DATA RESPONSES

The numbers in this section directly correspond to the questions in Attachment 46-1.

1. If yes, check safety performance history with previous URS Corporation Project Manager if unknown.
2. For any EMR listed as greater than 1.0 the contractor has failed the evaluation. Further consideration may not occur without referral to URS Corporation Health and Safety Program Professional in your Region for further assessment.

If all EMRs listed are 1.0 or below, continue with evaluation.

3. Determine the most recent OSHA Incident Rate and Lost Workday Case Rate for the subcontractors SIC. This may be done online at <http://www.osha.gov/oshstats/work.html>.

For rates in excess of the published averages the subcontractor has failed the evaluation. Further consideration may not occur without referral to URS Corporation Health and Safety Program Professional in your Region for further assessment.

If the rates are at or below the average for the subcontractors SIC, continue with the assessment.

4. Determine the subcontractor's citation history at <http://www.osha.gov/cgi-bin/est/est1>. Compare the published data to the contractor questionnaire. The subcontractor must explain any discrepancies.

Look for large numbers of serious and repeat violations. If the suggests a problem request information and refer to URS Corporation Health and Safety Program Professional in your Region for further assessment.



**SUBCONTRACTOR
EVALUATION CRITERIA**

5. If subcontractor answers yes to willful violations request a detailed explanation and refer to URS Corporation Health and Safety Program Professional in your Region for further assessment.
6. For small subcontractors a no answer is not unexpected and may be acceptable with good EMR and OSHA statistics. Generally some minimal program is expected depending on the breadth and complexity of the work. Contact URS Corporation Health and Safety Program Professional in your Region for further assessment if you have any questions or doubts.
7. See 6.
8. It is expected that a subcontractor being hired to perform services on the project site should be the best prepared to address safety issues for their operations, especially when specialty work is being conducted or for work in which the subcontractor possesses superior knowledge of their operations.

A 'no' answer should be referred to the URS Corporation Health and Safety Program Professional in your Region for further assessment.

RISK MANAGEMENT/INSURANCE DATA

1. The inability to provide insurance coverage at or above \$1,000,000 requires referral to Counsel.
2. Proof of Workers Compensation Insurance is required. Refer any questions to Counsel.
3. Ability to provide Insurance Certificates naming URS Corporation as an additional insured is required. Refer any questions to Counsel.



Health and Safety Program
INCIDENT REPORT FORM

Attachment 49-1

ADMINISTRATIVE INFORMATION:

URS Division/Company: _____

Project Office: _____

Project Number: _____

Date/Time of Incident: Date _____ Time _____

Location: _____

FOR INJURIES / ILLNESSES:

Name of Injured
Employee: _____

Age: _____

Sex: ☐ Male ☐ Female

See a Doctor? ☐ Yes ☐ No
If yes, attach a doctor's report.

Describe Injury:

TYPE OF INCIDENT
(Check all applicable items)

☐ Illness	☐ Injury	☐ Fire, Explosion, Flash	☐ Unexpected Exposure
☐ Property Damage	☐ Vehicular Accident	☐ Other (describe): _____	

DESCRIPTION OF INCIDENT: (Describe the facts contributing to the incident. Identify individuals involved, witnesses, and their affiliations. Attach additional sheets, drawings, or photographs as needed.)

Health and Safety Program

INCIDENT REPORT FORM

Attachment 49-1

PREPARED BY:

Name: _____

Date: _____

Signature: _____

Reporter must deliver this report to the operating unit health and safety representative within 24 hours of the reported incident for medical treatment cases and within 5 days for other incidents.

REVIEWED BY:

Supervisor

Date _____

Health and Safety Representative

Date _____

DISTRIBUTION:

- Division Health and Safety Manager
- Project File
- Occupational Health Specialist (Fax 512-419-6013)
- Local Human Resources (Injury / Illness cases only)

CORRECTIVE ACTIONS *(For Internal Use Only):*

**BLOODBORNE PATHOGENS
EXPOSURE CONTROL PLAN****1. INTRODUCTION**

Employees are at risk for exposure to and possible transmission of infectious diseases each time they are in contact with blood or body fluids. Bloodborne pathogens are microorganisms present in human blood and other body fluids that can cause serious disease in humans and include, but are not limited to Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and Human Immunodeficiency Virus (HIV). Therefore, this exposure control plan (ECP) has been established to ensure that employees are effectively informed concerning potential workplace health hazards and that protective measures necessary to eliminate or minimize bloodborne exposure incidents are utilized whenever possible.

2. EXPOSURE DETERMINATION

The Medical Surveillance Evaluation form will be used to evaluate which employees may incur occupational exposure to blood or other potentially infectious materials when performing routine tasks and procedures. These exposure determinations will be made without regard to the use of personal protective equipment and regardless of exposure frequency.

The employees in the following job classifications may have occupational exposure to bloodborne pathogens and are covered by this program:

- Occupational health nurse
- Designated first aid providers
- Medical laboratory employees

Tasks and procedures which may expose employees to bloodborne pathogens include:

- Treating cuts, abrasions, and burns
- Cleaning contaminated environmental surfaces
- Administering cardiopulmonary resuscitation (CPR)
- Collecting samples at municipal waste sites or sewage lagoons
- Environmental sewer samplers or sewer construction workers
- Construction of residential sewer lines

3. EXPOSURE CONTROL

- A. "Universal precautions" are a required method of control to prevent exposure to blood and body fluids. This term refers to the concept that all human blood

**BLOODBORNE PATHOGENS
EXPOSURE CONTROL PLAN**

and certain human body fluids are treated as if known to be infectious for HIV, HBV, HCV, and other bloodborne pathogens, regardless of the perceived risk status of another individual. Universal precautions apply to blood, other body fluids containing visible blood, semen, and vaginal fluids. Universal precautions do not apply to feces, nasal secretions, saliva, sweat, tears, sputum, urine, and vomitus unless they contain visible blood. Although these fluids have an extremely low or nonexistent risk for bloodborne pathogens, they are a potential source for other infectious diseases and precautions should also be followed when these body fluids are present.

B. Engineering and Work Practice Controls

The following engineering controls shall be in place in all areas of occupational exposure:

1. Accessible handwashing facilities. If soap and running water are not available, an antiseptic hand cleaner in conjunction with clean paper towels or antiseptic towelettes are acceptable temporary alternatives to running water. When this alternative method is used, employees must wash their hands with soap and running water as soon as feasible.
2. Containers for disposable contaminated sharps will be puncture resistance, labeled a biohazard, leakproof, and have a closable top.
3. Containers for storage, transport, or shipment of blood or other potentially infectious materials, regulated waste, and contaminated laundry will be labeled with the biohazard symbol, site address, and have a securely closing lid.

The following work practice controls must be strictly followed to minimize exposure and isolate or remove bloodborne pathogens from the workplace:

4. Personal protective equipment will be provided at no cost to the employee will be chosen based on the anticipated exposure to blood. PPE is considered appropriate if it does not permit blood or other potentially infectious materials to reach or pass through clothes, skin, or mucous membranes of the eyes or mouth under normal conditions of use and for the duration of time the equipment will be used. PPE must be readily accessible and will be removed prior to leaving the work area.
 - a. Disposable, single use gloves shall be used as a protective barrier in all situations in which contact with body fluids is anticipated. Gloves of the correct size will be provided. Disposable gloves will not be washed or disinfected for reuse and will be replaced between employees and if they become

BLOODBORNE PATHOGENS EXPOSURE CONTROL PLAN

torn or punctured. Gloves are especially important if the employee has cuts, abraded skin, chapped hands, or dermatitis.

- b. Liquid impermeable gowns, boots, and masks, in combination with eye protective devices such as goggles and shatterproof glasses with solid-side shields or chin-length face shields, shall be worn whenever splashing, spraying, or spattering of blood droplets or body fluids can be reasonably anticipated.
- c. Disposable pocket mask ventilation devices should be provided in all first aid kits and used to avoid mouth-to-mouth contact during emergency cardiopulmonary resuscitation.

Examples of Recommended PPE (depending on task, more PPE may be needed).

<u>Task</u>	<u>Gloves</u>	<u>Gown</u>	<u>Mask</u>	<u>Goggles</u>	<u>Boots</u>
Bleeding control w/ minimal bleeding	Yes	No	No	No	No
Bleeding control w /spurting blood	Yes	Yes	Yes	Yes	No
Cardiopulmonary resuscitation	No	No	Yes	No	No
Decontamination/clean-up	Yes	No	No	No	No
Collection of sewage waste	Yes	No	No	Yes	Yes
Construction of sewage lines	Yes	No	No	Yes	Yes
Medical laboratory activities	Yes	Yes	Yes	Yes	No

5. Eating, drinking, smoking, applying cosmetics, and handling of contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure. Food and drink will not be kept in refrigerators, freezers, shelves, cabinets, or on counter tops where blood or body fluids are present.
6. Contaminated needles and other sharps will not be bent or recapped unless a one-handed technique is used. They will be disposed of in an appropriate sharps container.
7. All regulated, biohazardous waste will be placed in a waste receptacle that has designated red biohazard bags and a closable top controlled by a foot peddle. When full, the bags shall be removed with gloved hands, tied off, and placed in a biohazard shipping carton, to be held for pick-up. If any biohazard bag appears to be leaking, it must be double-bagged. The waste will be incinerated per federal and state regulations.

C. Housekeeping



BLOODBORNE PATHOGENS EXPOSURE CONTROL PLAN

1. Universal precautions will be used when cleaning or decontaminating any surface or equipment that may be contaminated. Appropriate PPE will be used for protection during decontamination.
2. All contaminated environmental work surfaces such as countertops or floors will be cleaned with a household bleach solution diluted 1:10 with water directly following contamination with blood or body fluids.
3. Instruments such as tweezers, bandage scissors, and thermometers will be disposable rather than reusable equipment and will be disposed of in an appropriate manner.
4. Broken, contaminated glassware will not be picked up directly with the hands. It will be cleaned up using a mechanical means such as a brush and dustpan or tongs.

4. HEPATITIS B VACCINATION

Within 10 working days of placement, all employees assigned to tasks with potential occupational exposure to bloodborne pathogens will be offered the Hepatitis B vaccination at no cost to the employee, unless the employee has had a previous Hepatitis B vaccination series, antibody testing reveals the employee is immune or the vaccine is contraindicated for medical reasons. Further, this vaccination series will be made immediately available to employees who have an occupational exposure whether as a result of their assigned tasks or occurring from an incidental contact.

The local occupational medical facility used for routine medical surveillance will administer the vaccinations.

Employees who decline the Hepatitis B vaccine will sign a copy of the waiver form located at the end of this attachment. The signed waiver will be stored in the employee's medical record with the Occupational Health Specialist. Employees may initially decline the vaccination, but at a later date, while still covered under this plan, may then decide to take them. The vaccinations will be made available to the employee at that time.

Employees choosing to take the vaccination series will sign a consent form at the occupational clinic prior to receiving the injections and are advised to read the package insert regarding the efficacy, safety, method of administration, and benefits of the vaccine. Employees may also ask questions directly of the Medical Service Provider or local occupational physician. Employees are not required to participate in a prescreening program (to determine immunity) before receiving the vaccinations. If a routine booster of Hepatitis B vaccine is recommended by the U.S. Public Health Service at a future date, such booster dose(s) will be made available to affected employees.

**BLOODBORNE PATHOGENS
EXPOSURE CONTROL PLAN****5. POST-EXPOSURE INCIDENT EVALUATION AND FOLLOW-UP**

All occupational bloodborne pathogen exposures are to be reported to a Health & Safety Representative or the Occupational Health Specialist immediately after initial decontamination first aid is accomplished. Following the report of an exposure incident, a confidential medical evaluation with an occupational physician will be arranged as soon as possible, ideally no later than 1-2 hours after the incident has occurred. In some states, depending on applicable workers' compensation law, employees may choose treatment from their personal physician. A copy of the Bloodborne Pathogen Standard will be provided if the physician does not have a copy. A written URS Incident Report will be completed as soon as possible, fully describing the incident.

A. First aid protocol for treatment immediately after an exposure incident:

1. Lacerations, punctures, and abrasions should be washed under cool running water for at least 5 minutes allowing free bleeding. Cleanse area well with soap or iodine solution. Apply sterile dressing as needed. Give tetanus booster if indicated (7-10 years since last booster).
2. Ocular exposure requires irrigation of the eye with water or sterile normal saline solution for 15 minutes.
3. Mucous membrane exposure requires rinsing mouth with ½ strength 3% hydrogen peroxide for 30 seconds, four separate and consecutive times.

B. Confidential Medical Evaluation

1. The treating occupational physician will receive documentation of the routes of exposure, the circumstances surrounding the incident, and identification of the source individual (the individual the employee was exposed to). The blood of the source individual will be tested if possible and after consent is obtained. When legally permissible, results of testing of the source individual will be made available to the exposed employee with the exposed employee informed about the applicable laws and regulations concerning the disclosure of the identity and infectivity of the source individual.
2. Testing of the exposed employee's blood, if consented to (the employee may consent to baseline blood collection, but may request that the sample not be tested for HIV for up to 90 days, if at all), is recommended.

**BLOODBORNE PATHOGENS
EXPOSURE CONTROL PLAN**

3. Post-exposure medical treatment will be offered in accordance with the current recommendations of the U.S. Public Health Services. This may include, but is not limited to:

- a. A series of HIV post-exposure blood tests
- b. Hepatitis B vaccination and/or Hepatitis B immune globulin
- c. HIV post-exposure prophylactic medications
- d. Evaluation of acute febrile illnesses following exposure
- e. Employee counseling concerning precautions to take during the period after the exposure incident and information on signs and symptoms of potential illnesses.

C. Healthcare Professional's Written Opinion

The Occupational Health Specialist will obtain and provide the employee with a copy of the evaluating physician's written opinion within 15 days of the completion of the medical evaluation. A copy will be maintained in the employee's confidential medical record. The written opinion will be in accordance with the requirements of the Bloodborne Pathogens Standard indicating that the employee has been informed of any medical conditions resulting from exposure that require further evaluation or treatment. All other findings or diagnoses will remain confidential and will not be included in the report.

6. HAZARD COMMUNICATION

- A. Fluorescent red or orange-red warning labels bearing the universal biohazard symbol and the legend BIOHAZARD must be firmly affixed to all containers (e.g. waste cans, sharps containers, and refrigerators) used for the storage or shipment of blood or other potentially infectious materials.
- B. All employees designated to perform tasks involving occupational exposure shall receive bloodborne pathogens training at the time of initial assignment to the job. This training will be given during working hours and at no cost to employees. Refresher courses will be provided annually and if new tasks or procedures are implemented. Material appropriate in content and vocabulary to education level, literacy, and language of the employees shall be used for all required training. The Division Health & Safety Representatives will be the qualified instructors for the training classes.

Training will include: making accessible a copy of the regulatory text of the standard and explanation of its contents, general discussion on bloodborne diseases and their transmission, exposure control plan, engineering and work



BLOODBORNE PATHOGENS EXPOSURE CONTROL PLAN

practice controls, personal protective equipment, hepatitis B vaccine, response to emergencies involving blood, how to handle exposure incidents, the post-exposure evaluation and follow-up program, signs/labels/color-coding, and question and answer time with the trainer.

7. EXPOSURE INCIDENT INVESTIGATION

The site Health & Safety Representative will review the circumstances of any exposure incident to determine corrective actions. The incident report will include:

- A. Engineering controls in use at the time
- B. Work practices followed
- C. A description of any equipment being used
- D. A description of the work being performed
- E. PPE that was used at the time of the incident
- F. Date, time, and location of the incident
- G. Employee's training

Within 24 hours, a copy of this incident report will be forwarded to the Occupational Health Specialist and Division Health & Safety Manager who will evaluate what follow-up actions should be addressed, including if revisions need to be made to the Exposure Control Plan.

8. RECORDKEEPING

- A. The Occupational Health Specialist will be responsible for establishing and maintaining accurate, confidential workers' compensation medical records for each employee with occupational exposure for the duration of employment plus 30 years in accordance with OSHA 29 CFR 1910.1020 "Access to Employee Exposure and Medical Records".
- B. The Division Health & Safety Manager will responsible for maintaining the bloodborne pathogens training class records for at least 3 years from the date of training. The records will include the date of the training class, a summary of the class contents, the names of the qualified instructors, and the names and job titles of person attending the training.
- C. Employee medical records will be made available to employees (or their designated representative) with written consent by the employee within 15 working days of request.



**BLOODBORNE PATHOGENS
EXPOSURE CONTROL PLAN**

- D. An exposure incident will be evaluated by the Occupational Health Specialist and Corporate Health & Safety Managers to determine if the case meets OSHA's Recordkeeping Requirements (29 CFR 1904).



**BLOODBORNE PATHOGENS
EXPOSURE CONTROL PLAN**

HEPATITIS B VACCINATION DECLINATION FORM

I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to myself. However, I decline hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccine series at no cost to me.

Name _____

Date _____

Witness _____

Date _____

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS

Please reduce your browser font size for better viewing and printing

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-998-6666

Outside U.S. and Canada
ChemTrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ALCONOX(R)

MSDS Number: A2052 --- Effective Date: 02/21/00

1. Product Identification

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.

CAS No.: Not applicable.

Molecular Weight: Not applicable to mixtures.

Chemical Formula: Not applicable to mixtures.

Product Codes: A461

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Alconox(R) proprietary detergent mixture	N/A	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:

May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.

Ingestion:

May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.

Skin Contact:

No adverse effects expected.

Eye Contact:

May cause irritation, redness and pain.

Chronic Exposure:

No information found.

Aggravation of Pre-existing Conditions:

No information found.

4. First Aid Measures

Inhalation:

Remove to fresh air. Get medical attention for any breathing difficulty.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Wash exposed area with soap and water. Get medical advice if irritation develops.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not expected to be a fire hazard.

Explosion:

No information found.

Fire Extinguishing Media:

Dry chemical, foam, water or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL):

15 mg/m³ total dust, 5 mg/m³ respirable fraction for nuisance dusts.

- ACGIH Threshold Limit Value (TLV):

10 mg/m³ total dust containing no asbestos and < 1% crystalline silica for Particulates Not Otherwise Classified (PNOC).

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels

are not known, use a full-facepiece positive-pressure, air-supplied respirator.
WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White powder interspersed with cream colored flakes.

Odor:

No information found.

Solubility:

Moderate (1-10%)

Specific Gravity:

No information found.

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

No information found.

Melting Point:

No information found.

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

No information found.

Conditions to Avoid:

No information found.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Alconox(R) proprietary detergent mixture	No	No	None

12. Ecological Information

Environmental Fate:

This product is biodegradable.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Alconox(R) proprietary detergent mixture	Yes	No	No	No

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	--Canada--			
	Korea	DSL	NDSL	Phil.

Alconox(R) proprietary detergent mixture	No	No	Yes	No

-----\Federal, State & International Regulations - Part 1\-----				
	-SARA 302-		-----SARA 313-----	
Ingredient	RQ	TPQ	List	Chemical Catg.
Alconox(R) proprietary detergent mixture	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----			
	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Alconox(R) proprietary detergent mixture	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
 Reactivity: No (Pure / Solid)

Australian Hazchem Code: No information found.

Poison Schedule: No information found.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 0 Flammability: 0 Reactivity: 0

Label Hazard Warning:

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

Label Precautions:

Avoid contact with eyes.
 Keep container closed.
 Use with adequate ventilation.
 Avoid breathing dust.
 Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16.

Disclaimer:

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

**AIR LIQUIDE**

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: **ISOBUTYLENE**

SYNONYMS: 2-Methylpropane; Isobutylene USP

CHEMICAL FAMILY: Alkane (hydrocarbon)

FORMULA: C₄H₈

PRODUCT USE:

Document Number: 20103

For fuel and synthetic chemical use; food additive, agricultural uses, aerosol propellant, refrigerant.

SUPPLIER/MANUFACTURER'S NAME:

AIR LIQUIDE AMERICA CORPORATION

ADDRESS:

2700 Post Oak Drive
Houston, TX 77056-8229

EMERGENCY PHONE:

CHEMTREC: 1-800-424-9300

BUSINESS PHONE:

General MSDS Information: 1-713/896-2896

Fax on Demand: 1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Isobutylene	115-11-7	> 99%	There are no specific exposure limits for Isobutylene. Isobutylene is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Maximum Impurities		< 1%	None of the trace impurities in this product contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalents standards.					

NE = Not Established

C = Ceiling Limit

NOTE: all WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a colorless, liquefied, flammable gas. The gas has an unpleasant odor similar to burning coal. Both the liquid and gas pose a serious fire hazard when accidentally released. Rapid evaporation of liquid from cylinder may cause frostbite. Flame or high temperature impinging on a localized area of the cylinder of this product can cause the cylinder to burst or rupture without activating the cylinder's relief devices. Isobutylene is an asphyxiant and presents a significant health hazard by displacing the oxygen in the atmosphere. Isobutylene can also be a narcotic at high concentrations. Provide adequate fire protection during emergency response situations.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation.

INHALATION: Isobutylene also has some degree of anesthetic action and can be mildly irritating to the mucous membranes. High concentrations of this gas can cause an oxygen-deficient environment. It should be noted that before suffocation could occur, the lower flammability limit of Isobutylene in air would be exceeded; possibly causing an oxygen-deficient and explosive atmosphere. Individuals breathing an oxygen deficient atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

<u>CONCENTRATION</u>	<u>SYMPTOM OF EXPOSURE</u>
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea and vomiting, collapse or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

OTHER POTENTIAL HEALTH EFFECTS: Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: The most significant hazard associated with this product is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, and, at high concentrations, unconsciousness or death may occur. The skin of a victim of over-exposure may have a blue color. Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with liquid can quickly subside.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to the components of this compressed gas.

TARGET ORGANS: Respiratory system.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	0
FLAMMABILITY		(RED)	4
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT		B	
EYES	RESPIRATORY	HANDS	BODY
See Section 8			
For routine industrial applications			

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

Remove victim(s) to fresh air, as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

4. FIRST-AID MEASURES (Continued)

SKIN EXPOSURE: Exposure to the liquefied gas can cause frostbite. Remove any clothing that may restrict circulation to any frozen area. Do not rub frozen parts as tissue damage may occur. As soon as practicable, place any affected area in warm water bath which has a temperature that does not exceed 105°F (40°C). NEVER USE HOT WATER. NEVER USE DRY HEAT. If area of frostbite is extensive, and if possible, remove clothing while showering with warm water. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area of the body in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

Frozen tissue is painless and appears waxy, with a possible yellow color. Frozen tissue will become swollen, painful and prone to infection when thawed. If the frozen part of the body has been thawed by the time medical attention has been obtained, cover the area with a dry sterile dressing and a large bulky protective covering.

EYE EXPOSURE: If liquid is splashed into eyes, or if irritation of the eye develops after exposure to liquid or gas, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT: -10°C (< 14°F)

AUTOIGNITION TEMPERATURE: 465°C (869°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.8%

Upper (UEL): 9.6%

FIRE EXTINGUISHING MATERIALS: Extinguish Isobutylene fires by shutting-off the source of the gas. Use water spray to cool fire-exposed containers, structures, and equipment.

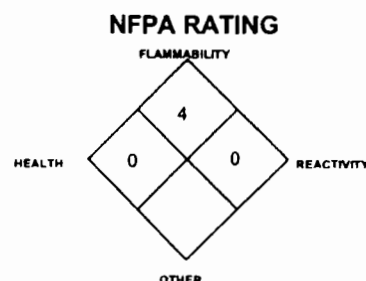
UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this material may decompose and produce toxic gases including carbon monoxide and carbon dioxide.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected cylinders of this product can be very dangerous. Exposure to fire could cause a catastrophic failure of the cylinder releasing the contents into a fireball and explosion of released gas. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the cylinder. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause this product to ignite explosively, if released.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Because of the potential for a BLEVE, evacuation of non-emergency personnel is essential. If water is not available for cooling or protection of cylinder exposures, evacuate the area. The North American Emergency Response Guidebook (Guide #115) recommends 0.5 miles. Other information for pre-planning can be found in the American Petroleum Institute Publications 2510 and 2510A.



6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a gas release, clear the affected area, protect people, and respond with trained personnel.

Eliminate any possible sources of ignition, and provide maximum explosion-proof ventilation. If the gas is leaking from cylinder or valve, contact the supplier. Adequate fire protection must be provided. Use only non-sparking tools and equipment during the response.

Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves and Self-Contained Breathing Apparatus**. Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas to dissipate.

6. ACCIDENTAL RELEASE MEASURES (Continued)

Combustible gas concentration must be below 10% of the LEL (1.8%) prior to entry. Monitor the surrounding area for combustible gas levels and oxygen level. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

THIS IS AN EXTREMELY FLAMMABLE GAS. Protection of all personnel and the area must be maintained.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this product could occur without any significant warning symptoms. Non-sparking tools should be used.

STORAGE AND HANDLING PRACTICES: Specific requirements are listed in NFPA 58. Cylinders should be stored upright (with valve-protection cap in place) and firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52 °C (125 °F). Store containers away from heavily trafficked areas and emergency exits. Store away from process and production areas, away from elevators, building and room exits or main aisles leading to exits. Protect cylinders against physical damage.

Cylinders should be separated from oxygen cylinders, or other oxidizers, by a minimum distance of 20 ft., or by a barrier of non-combustible material at least 5 ft. high, having a fire-resistance rating of at least 0.5 hours. Isolate from other incompatible chemicals (refer to Section 10, Stability and Reactivity).

Storage areas must meet national electrical codes for Class 1 Hazardous Areas. Post "No Smoking or Open Flames" signs in storage or use areas. Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers).

Keep the smallest amount on-site as is necessary. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time.

Use non-sparking ventilation systems, approved explosion-proof equipment, and appropriate electrical systems. Electrical equipment used in gas-handling operations, or located in storage areas, should be non-sparking or explosion proof. Use a check valve in the discharge line to prevent hazardous backflow. Never tamper with pressure relief devices in valves and cylinders.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Use piping and equipment adequately designed to withstand pressures to be encountered. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Do not use oils or grease on gas-handling fittings or equipment. Do not "crack" valve open before connecting it, since self-ignition may occur. Leak check system with leak detection solution, never with flame. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc on a compressed gas cylinder or make a cylinder part of an electric circuit.

After Use: Close main cylinder valve. Valves should be closed tightly. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers designed for flammable gas storage. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty.

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper connections, DO NOT USE ADAPTERS:

THREADED: 0-500 PSIG - CGA 510

PIN-INDEXED YOKE: Not Applicable.

ULTRA HIGH INTEGRITY: Not Applicable.

7. HANDLING and USE (Continued)

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (i.e. nitrogen) before attempting repairs. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Provide natural or explosion-proof ventilation adequate to ensure Isobutylene does not reach its lower flammability limit of 1.8%. Local exhaust ventilation is preferred, because it prevents gas dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of flammable gas.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% (air-purifying respirators will not function) or during emergency response to a release of this product. During an emergency situation, before entering the area, check for flammable gas level as well as oxygen-deficient atmospheres. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: Wear leather gloves when handling cylinders of this product. Otherwise, wear glove protection appropriate to the specific operation for which this product is used. Use low-temperature protective gloves when working with containers of Liquid Isobutylene.

BODY PROTECTION: Use body protection appropriate for task. Cotton clothing is recommended for use to prevent static electric build-up. Safety shoes are recommended when handling cylinders. Transfer of large quantities under pressure may require use of fire retardant clothing.

9. PHYSICAL and CHEMICAL PROPERTIES

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.14957 lb/ft³ (2.3959 kg/m³)

BOILING POINT: -6.9°C (19.6°F)

FREEZING/MELTING POINT @ 10 psig: -140°C (-220.6°F)

SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F): 1.997

pH: Not applicable.

SOLUBILITY IN WATER vol/vol @37.8°C (100°F): Insoluble.

MOLECULAR WEIGHT: 56.108

EVAPORATION RATE (nBuAc = 1): Not applicable.

EXPANSION RATIO: Not applicable.

ODOR THRESHOLD: Not determined.

SPECIFIC VOLUME (ft³/lb): 6.54

VAPOR PRESSURE @ 21.1°C (70°F) psig: 23.85

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

APPEARANCE AND COLOR: Colorless gas which is shipped as a liquefied gas under its own vapor pressure. The gas has an unpleasant odor similar to burning coal.

HOW TO DETECT THIS SUBSTANCE (warning properties): The unpleasant odor may be a warning property. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: : When ignited in the presence of oxygen, this gas will burn to produce carbon monoxide, carbon dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicity data are applicable for pure Isobutylene.

LC50 (inhalation, rat) = 620,000 mg/kg/4 hours

LC50 (inhalation, mouse) = 415,000 mg/kg

SUSPECTED CANCER AGENT: Isobutylene is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA; therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Isobutylene can cause some irritation to mucus membranes. In addition, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: Isobutylene is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Isobutylene on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for Isobutylene gas.

Embryotoxicity: No embryotoxic effects have been described for Isobutylene gas.

Teratogenicity: No teratogenicity effects have been described for this Isobutylene gas.

Reproductive Toxicity: No reproductive toxicity effects have been described for Isobutylene gas.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by over-exposure to the components of this product.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Isobutylene.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary; treat symptoms; reduce or eliminate exposure.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen deficient environments. No adverse effect is anticipated to occur to plant-life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Air Liquide. Do not dispose of locally.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors, away from all sources of ignition.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Isobutylene	Alternate Description:
HAZARD CLASS NUMBER and DESCRIPTION:	2.1 (Flammable Gas)	Petroleum gases, liquefied
UN IDENTIFICATION NUMBER:	UN 1055	2.1 (Flammable Gas)
PACKING GROUP:	Not applicable.	UN 1075
DOT LABEL(S) REQUIRED:	Flammable Gas	Not applicable.
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):	115	Flammable Gas

14. TRANSPORTATION INFORMATION (Continued)

MARINE POLLUTANT: Isobutylene is not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b)).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Isobutylene is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL INVENTORY STATUS: Isobutylene is listed on the Canadian DSL Inventory.

U.S. TSCA INVENTORY STATUS: Isobutylene is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS:

- Isobutylene does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for of this gas is 10,000 pounds.
- Depending on specific operations involving the use of this product, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Isobutylene is not listed in Appendix A, however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lbs (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.
- Isobutylene is listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Releases as a flammable substance. The threshold quantity for Isobutane under this regulation is 10,000 lbs.

OTHER CANADIAN REGULATIONS: Isobutylene is categorized as a Controlled Product, Hazard Classes A, and B1 as per the Controlled Product Regulations.

U.S. STATE REGULATORY INFORMATION: Isobutylene is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Liquefied Petroleum Gas.

California - Permissible Exposure Limits for Chemical Contaminants:

Florida - Substance List: Isobutylene.

Illinois - Toxic Substance List: Liquefied Petroleum Gas.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Isobutylene.

Minnesota - List of Hazardous Substances: Isobutylene.

Missouri - Employer Information/Toxic Substance List: Liquefied Petroleum Gas.

New Jersey - Right to Know Hazardous Substance List: Isobutylene.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.

Pennsylvania - Hazardous Substance List: Isobutylene.

Rhode Island - Hazardous Substance List: Liquefied Petroleum Gas.

Texas - Hazardous Substance List: Liquefied Petroleum Gas.

West Virginia - Hazardous Substance List: Liquefied Petroleum Gas.

Wisconsin - Toxic and Hazardous Substances: Liquefied Petroleum Gas.

CALIFORNIA PROPOSITION 65: Isobutylene is not on the California Proposition 65 lists.

16. OTHER INFORMATION

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 *"Safe Handling of Compressed Gases in Containers"*
P-14 *"Accident Prevention in Oxygen-Rich and Oxygen Deficient Atmospheres"*
SB-2 *"Oxygen Deficient Atmospheres"*
 "Handbook of Compressed Gases"

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

Fax on Demand: 1-800/231-1366



This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Air Liquide America Corporation's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

Please reduce your browser font size for better viewing and printing.

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-896-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SULFURIC ACID, 52 - 100 %

MSDS Number: S8234 --- Effective Date: 09/14/00

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid

CAS No.: 7664-93-9

Molecular Weight: 98.08

Chemical Formula: H₂SO₄ in H₂O

Product Codes:

J.T. Baker: 5030, 5137, 5374, 5802, 5815, 5889, 5960, 5961, 5971, 6902, 9673, 9674, 9675, 9676, 9679, 9680, 9681, 9682, 9684, 9687, 9691, 9693, 9694

Mallinckrodt: 2468, 2876, 2878, 2900, 2904, 3780, 4222, 5524, 5557, H644, H976, H996, V344, V651

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	52 - 100%	Yes
Water	7732-18-5	0 - 48%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR

CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 3 - Severe (Water Reactive)

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.

Ingestion:

Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.

Skin Contact:

Corrosive. Symptoms of redness, pain, and severe burn can occur. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow skin contact or ingestion. Circulatory shock is often the immediate cause of death.

Eye Contact:

Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.

Chronic Exposure:

Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult,

give oxygen. Call a physician immediately.

Ingestion:

DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.

Eye Contact:

Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

5. Fire Fighting Measures

Fire:

Concentrated material is a strong dehydrating agent. Reacts with organic materials and may cause ignition of finely divided materials on contact.

Explosion:

Contact with most metals causes formation of flammable and explosive hydrogen gas.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Do not use water on material. However, water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB(R) or TEAM(R) 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Sulfuric Acid:

- OSHA Permissible Exposure Limit (PEL) -

1 mg/m³ (TWA)

- ACGIH Threshold Limit Value (TLV) -

1 mg/m³(TWA), 3 mg/m³ (STEL), A2 - suspected human carcinogen for sulfuric acid contained in strong inorganic acid mists.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear oily liquid.

Odor:

Odorless.

Solubility:

Miscible with water, liberates much heat.

Specific Gravity:

1.84 (98%), 1.40 (50%), 1.07 (10%)

pH:

1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca. 0.05% w/w) = 2.1.

% Volatiles by volume @ 21C (70F):

No information found.

Boiling Point:

ca. 290C (ca. 554F) (decomposes at 340C)

Melting Point:

3C (100%), -32C (93%), -38C (78%), -64C (65%).

Vapor Density (Air=1):

3.4

Vapor Pressure (mm Hg):

1 @ 145.8C (295F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Concentrated solutions react violently with water, spattering and liberating heat.

Hazardous Decomposition Products:

Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Water, potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.

Conditions to Avoid:

Heat, moisture, incompatibles.

11. Toxicological Information

Toxicological Data:

Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m³/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.

Carcinogenicity:

Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sulfuric Acid (7664-93-9)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.

Environmental Toxicity:

LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified;

LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified;

LC50 Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.

This material may be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SULFURIC ACID (WITH MORE THAN 51% ACID)

Hazard Class: 8

UN/NA: UN1830

Packing Group: II

Information reported for product/size: 440LB

International (Water, I.M.O.)

Proper Shipping Name: SULPHURIC ACID (WITH MORE THAN 51% ACID)

Hazard Class: 8

UN/NA: UN1830

Packing Group: II

Information reported for product/size: 440LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Sulfuric Acid (7664-93-9)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	Canada-- DSL	NDSL	Phil.
Sulfuric Acid (7664-93-9)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302- RQ	TPQ	-----SARA 313----- List	Chemical Catg.
Sulfuric Acid (7664-93-9)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8 (d)
Sulfuric Acid (7664-93-9)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: Yes (Pure / Liquid)

Australian Hazchem Code: 2P

Poison Schedule: No information found.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 2 Other: Water reactive

Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe mist.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Do not contact with water.

Label First Aid:

In all cases call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
ChemTrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID, 33 - 40%

MSDS Number: H3880 --- Effective Date: 11/17/99

1. Product Identification

Synonyms: Muriatic acid; hydrogen chloride, aqueous

CAS No.: 7647-01-0

Molecular Weight: 36.46

Chemical Formula: HCl

Product Codes:

J.T. Baker: 5367, 5537, 5575, 5800, 5814, 5839, 6900, 7831, 9529, 9530, 9534, 9535, 9536, 9537, 9538, 9539, 9540, 9544, 9548

Mallinckrodt: 2062, 2612, 2624, 2626, 5587, H611, H613, H987, H992, H999, V078, V628

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	33 - 40%	Yes
Water	7732-18-5	60 - 67%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR

INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.

Ingestion:

Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea. Swallowing may be fatal.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Extreme heat or contact with metals can release flammable hydrogen gas.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

If involved in a fire, use water spray. Neutralize with soda ash or slaked lime.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB(R) or TEAM(R) 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking

tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

5 ppm Ceiling

-ACGIH Threshold Limit Value (TLV):

5 ppm Ceiling

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Colorless, fuming liquid.

Odor:

Pungent odor of hydrogen chloride.

Solubility:

Infinite in water with slight evolution of heat.

Density:

1.18

pH:

For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

53C (127F) Azeotrope (20.2%) boils at 109C (228F)

Melting Point:

-74C (-101F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

190 @ 25C (77F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A strong mineral acid, concentrated hydrochloric acid is incompatible with many substances and highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.

Conditions to Avoid:

Heat, direct sunlight.

11. Toxicological Information

Inhalation rat LC50: 3124 ppm/1H; oral rabbit LD50: 900 mg/kg (Hydrochloric acid concentrated); investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.

Environmental Toxicity:

This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID

Hazard Class: 8

UN/NA: UN1789

Packing Group: II

Information reported for product/size: 475LB

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID

Hazard Class: 8

UN/NA: UN1789

Packing Group: II

Information reported for product/size: 475LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	--Canada--		Phil.
		DSL	NDSL	
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes

Water (7732-18-5) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----
-SARA 302- -SARA 313-----
Ingredient RQ TPQ List Chemical Catg.

Hydrogen Chloride (7647-01-0) 5000 500* Yes No
Water (7732-18-5) No No No No

-----\Federal, State & International Regulations - Part 2\-----
-RCRA- -TSCA-
Ingredient CERCLA 261.33 8(d)

Hydrogen Chloride (7647-01-0) 5000 No No
Water (7732-18-5) No No No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R

Poison Schedule: No information found.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Wash thoroughly after handling.

Store in a tightly closed container.

Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID, 50-70%

MSDS Number: N3660 --- Effective Date: 07/13/00

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%

CAS No.: 7697-37-2

Molecular Weight: 63.01

Chemical Formula: HNO₃

Product Codes:

J.T. Baker: 411D, 5371, 5555, 5801, 5826, 5876, 9597, 9598, 9600, 9601, 9602, 9604, 9606, 9607, 9616, 9617

Mallinckrodt: 1409, 2703, 2704, 6623, H988, H993, H998, V069, V077, V336, V561, V633, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER

MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 3 - Severe (Oxidizer)

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES

Storage Color Code: Yellow (Reactive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:

Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

Ingestion:

Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:

Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

Water spray may be used to keep fire exposed containers cool. Do not get water inside container.

Special Information:

Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB(R) or TEAM(R) 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

2 ppm (TWA), 4 ppm (STEL)

-ACGIH Threshold Limit Value (TLV):

2 ppm (TWA); 4 ppm (STEL)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Colorless to yellowish liquid.

Odor:

Suffocating, acid.

Solubility:

Infinitely soluble.

Specific Gravity:

1.41

pH:

1.0 (0.1M solution)

% Volatiles by volume @ 21C (70F):

100 (as water and acid)

Boiling Point:

122C (252F)

Melting Point:

-42C (-44F)

Vapor Density (Air=1):

2-3

Vapor Pressure (mm Hg):

48 @ 20C (68F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.

Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:

Light and heat.

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

-----\Cancer Lists\-----

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Nitric Acid (7697-37-2)	No	No	None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)
-----**Proper Shipping Name:** NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)**Hazard Class:** 8**UN/NA:** UN2031**Packing Group:** II**Information reported for product/size:** 75LB**International (Water, I.M.O.)**
-----**Proper Shipping Name:** NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)**Hazard Class:** 8**UN/NA:** UN2031**Packing Group:** II**Information reported for product/size:** 75LB**International (Air, I.C.A.O.)**
-----**Proper Shipping Name:** NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)**Hazard Class:** 8

UN/NA: UN2031
Packing Group: II
Information reported for product/size: 75LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----
Ingredient TSCA EC Japan Australia

Nitric Acid (7697-37-2) Yes Yes Yes Yes
Water (7732-18-5) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----
Ingredient Korea --Canada-- DSL NDSL Phil.

Nitric Acid (7697-37-2) Yes Yes No Yes
Water (7732-18-5) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----
Ingredient -SARA 302- -SARA 313-----
RQ TPQ List Chemical Catg.

Nitric Acid (7697-37-2) 1000 1000 Yes No
Water (7732-18-5) No No No No

-----\Federal, State & International Regulations - Part 2\-----
Ingredient CERCLA -RCRA- -TSCA-
261.33 8(d)

Nitric Acid (7697-37-2) 1000 No No
Water (7732-18-5) No No No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0 Other: **Oxidizer**

Label Hazard Warning:

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL
MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS
TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.

INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Wash thoroughly after handling.

Keep from contact with clothing and other combustible materials.

Do not store near combustible materials.

Store in a tightly closed container.

Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 1.

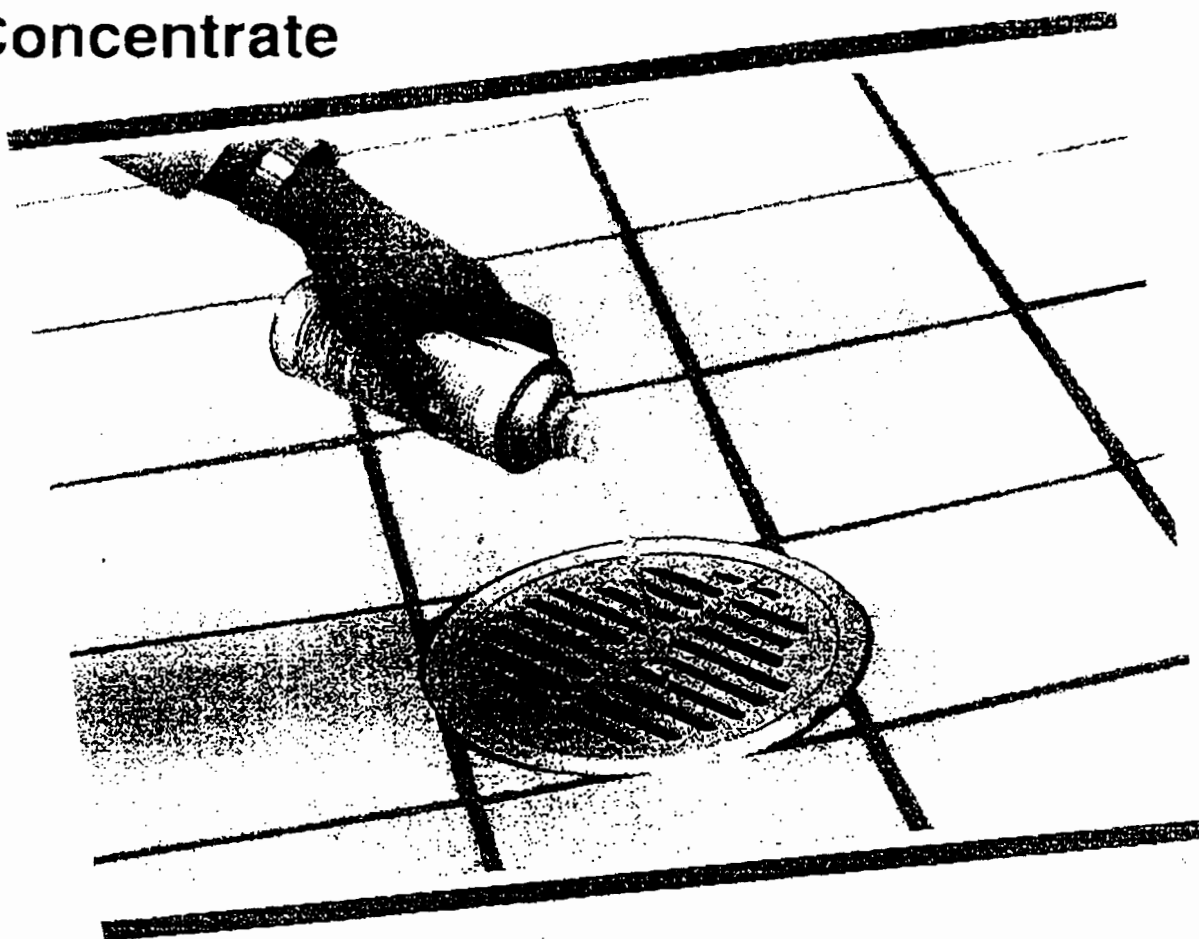
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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

CitruSolv Concentrate

Natural citrus solvents
in action!



Natural Degreaser Deodorizer Concentrate

Formulated with "natural citrus solvents" to **naturally degrease**, penetrate, and liquefy heavy grease and oil deposits from virtually any surface. Ideal for removing oily films from metal surfaces, unclogging drains and grease traps, removing tar from most hard surfaces, cleaning motors, removing adhesives and decals, and many other difficult cleaning tasks.

This formulation contains natural citrus solvent extracted from the peel of oranges. The refreshing citrus fragrance will tackle the most difficult deodorizing tasks. It is **non-conductive**, non-corrosive to metals, and **biodegradable**, yet possesses terrific solvency, grease dispersion, and deodorant qualities.

BENEFITS:

- **Contains** no hazardous components such as xylene, toluene, benzene, orthodichlorobenzene, 1,1,1-trichloroethane, trichloroethylene, or methylene chloride.
- **Non-acid**, non-caustic, non-corrosive to metal pipes, non-flaming and biodegradable.
- **Maintains** drains, grease traps, and septic tanks.
- **Cleans** greasy floors, walls, and equipment.
- **Removes** adhesives, decals, and chewing gum.
- **Controls** odors in problem areas.

BETCO
CORPORATION
Toledo, Ohio 43607

Technical Data

WHERE TO USE

- Spray cleaning of electrical motors, parts, and equipment.
- Dip cleaning of electrical motors, parts, and equipment.
- Eliminate scum cake and liquety grease in pumping stations, wet wells and sewer lines.

PROPERTIES

Fragrance	Citrus	Evaporation rate	Good
pH at 10% dilution with H ₂ O	8.0	Density	0.852
Color	Colorless	Corrosion to metals	None
Water rinsable	Yes	Hazardous ingredients as identified by the EPA Code of Federal Regulations Section 261.31	None
For non-conductive cleaning	Yes	Solvency	Excellent
Residue	Trace		
Flash point (undiluted)	125°F (TCC)		
Flash point (diluted with H ₂ O)	None		

SAFETY

Keep out of reach of children. For industrial and institutional use only by trained personnel. Material Safety Data Sheet available. **CAUTION:** Contains natural organic compounds. Do not take internally. Harmful if swallowed. Avoid skin and eye contact.

Combustible liquid. Keep away from heat, sparks and fire.

FIRST AID: In case of contact, flush eyes and/or skin with water.

If swallowed, do not induce vomiting. Get medical attention immediately.

DIRECTIONS FOR USE

Read the entire label before using this product. Although this product will not harm most plastics and painted surfaces, be sure to pre-test before using.

Drains, grease traps and septic tanks: To keep drain lines open, pour 4-8 ounces into drain, allow to stand for one hour, then flush with hot tap water. In garbage disposals, allow to stand 5-10 minutes, flush with hot water. Built up grease deposits: Mix 4 ounces to one gallon of warm water. Apply gener-

ously to greasy floors, walls, equipment, etc., with mop sponge, or rag. Allow to work for approximately 5 minutes, rinse with clean water.

Odor control: Mix 2-10 ounces of product to one gallon of cold water. Apply with sprayer to odor problem areas.

Wet wells, sewer lines and pumping stations: Drip directly into pumping stations and wet wells.

AUTHORIZATION

Authorized by the USDA for use in federally inspected meat and poultry plants. Classification C-1 for use on all surfaces in inedible product processing areas.

Betco Corporation

Material Safety Data Sheet

(Prepared According To 29 CFR 1910.1200)

Effective Date: 1/20/01

SECTION 1 - PRODUCT IDENTIFICATION

Number:	209	Chemical Family:	N/A	NFPA Hazardous Materials Identification System	
Name:	Citrusolv Concentrate	Formula:	N/A	Health	1
Trade Name:	Natural Degreaser/Deodorizer	Phone Number:	(419) 241-2156	Flammability	2
Supplier's Name:	Betco Corporation	Emergency:	613-995-8666	Reactivity	0
Supplier's Address:	1001 Brown Avenue, Toledo, Ohio 43607			Maximum Personal Protection	B

SECTION 2 - INGREDIENTS

CHEMICAL NAME	CAS NO.	WT. %	PEL	TWA-TLV	STEL-TLV	CARCINOGEN
Terpene	5989-27-5	10 to 100				No
Terpene	138-86-3	0 to 5				No
Alkylbenzene	9016-45-9	0 to 5				No
Alkylbenzene	8051-30-7	0 to 5				No
Alkylbenzene	532-32-1	0 to 5				No
Alkylbenzene	66455-15-0	0 to 5				No
Alkylbenzene	127087-87-0	0 to 5				No

SECTION 3 - PHYSICAL DATA

Boiling Range:	340°F initial	Specific Gravity:	55
Vapor Pressure:	<10mm Hg @ 56°F	Vapor Density:	(Air=1) >1
Volatility:	90+	pH:	N/A
Stability in Water:	Emulsifies	Evaporation Rate:	(Water=1) <1
Physical Description:	Thin colorless liquid with pleasant odor		

SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

Concentrate Flash Point (Method):	N/A	Explosive Limits	
Propellant Flash Point (Method):	N/A	Upper:	N/A
Flash Point (Method):	125°F (TCC)	Lower:	N/A
Extinguishing Media:	Foam, CO2, or dry chemical		
Special Fire Fighting Procedures:	Do not use water		
Unusual Fire and Explosion Hazards:	Drums heated by a fire can explode		

SECTION 5 - REACTIVITY DATA

Stability:	Stable	Hazardous Polymerization:	Will not occur.
Compatibility (Materials to Avoid):	None known.		

Hazardous Decomposition Products: Carbon monoxide possible if burned.

SECTION 6 - STORAGE AND HANDLING INFORMATION

Precautions to be Taken in Handling and Storage:	
Keep out of reach of children.	
Keep container closed during storage. For institutional and commercial use	

SECTION 7 - HEALTH HAZARDS AND FIRST AID

Reproductive Exposure:		First Aid Procedures:	
Route of Entry:		Skin:	Remove contaminated clothing. Flush with water. Seek medical attention if irritation occurs.
Defatting to skin with prolonged or repeated contact		Eyes:	Flush eyes with large quantities of water. Seek medical attention if irritation persists.
Eye Irritant: May cause redness, burning, or tearing.		Inhalation:	Get to fresh air. Seek medical attention if irritation persists.
Inhalation: May be irritating to mucous membranes of the nose, throat, and lungs.		Ingestion:	Dilute with water or milk. Seek medical attention.
Ingestion: May be irritating to the mouth, throat, and gastrointestinal system.			

SECTION 8 - SPECIAL PROTECTION INFORMATION

Respiratory Protection:	Use with adequate ventilation.	Ventilation:	Good general ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations.
Protective Gloves:	Solvent proof.	Eye Protection:	Safety glasses
Other Protective Equipment:	N/A		

SECTION 9 - SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled:	Waste Disposal Method:
Mop up or otherwise absorb and hold for disposal.	Any method in accordance with applicable laws.

MATERIAL SAFETY DATA SHEET: SIMPLE GREEN®

I. PRODUCT & COMPANY INFORMATION

PRODUCT NAME: SIMPLE GREEN® CLEANER / DEGREASER / DEODORIZER

Page 1 of 4

COMPANY NAME: SUNSHINE MAKERS, INC.

15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 • 562-795-6000
Fax: 562-592-3034
Website: www.simplegreen.com

Version No. 1008
Issue Date: January, 2003

For 24-hour emergency, call Chem-Tel, Inc.: 800-255-3924

USE OF PRODUCT: An all purpose cleaner and degreaser used undiluted or diluted in water for direct, spray, and dip tank procedures.

II. INGREDIENT INFORMATION

The only ingredient of Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<6%) (Butyl Cellosolve; CAS No. 111-76-2); the OSHA PEL and ACGIH TLV is 25 ppm (skin). Note, however, that Butyl Cellosolve is only one of the raw material ingredients that undergo processing and dilution during the manufacture of Simple Green®. Upon completion of the manufacturing process, Simple Green® does not possess the occupational health risks associated with exposure to undiluted Butyl Cellosolve. Verification of this is contained in the independent test results detailed under "Toxicological Information" on Page 3 of this MSDS.

The Butyl Cellosolve in Simple Green® is part of a chemical category (glycol ethers) regulated by the Emergency Planning and Community Right-to-Know Act (SARA, Title III, section 313); therefore, a reporting requirement exists. Based upon chemical analysis, Simple Green® contains no known EPA priority pollutants, heavy metals, or chemicals listed under RCRA, CERCLA, or CWA. Analysis by TCLP (Toxicity Characteristic Leaching Procedure) according to RCRA revealed no toxic organic or inorganic constituents.

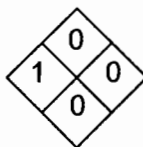
All components of Simple Green® are listed on the TSCA Chemical Substance Inventory.

III. HAZARDS IDENTIFICATION

UN Number: Not required
Dangerous Goods Class: Nonhazardous

Hazard Rating (NFPA/HMIS)

Health = 1* Reactivity = 0
Fire = 0 Special = 0



Rating Scale

0 = minimal 1 = slight
2 = moderate 3 = serious
4 = severe

*Mild eye irritant, non-mutagenic and non-carcinogenic. None of the ingredients in Simple Green® are regulated or listed as potential cancer agents by Federal OSHA, NTP, or IARC.

IV. FIRST AID MEASURES

SYMPTOMS OF OVEREXPOSURE AND FIRST AID TREATMENT

- Eye contact:** Reddening may develop. Immediately rinse the eye with large quantities of cool water; continue 10-15 minutes or until the material has been removed; be sure to remove contact lenses, if present, and to lift upper and lower lids during rinsing. Get medical attention if irritation persists.
- Skin contact:** Minimal effects, if any; rinse skin with water, rinse shoes and launder clothing before reuse. Reversible reddening may occur in some dermal-sensitive users; thoroughly rinse area and get medical attention if reaction persists.
- Swallowing:** Essentially non-toxic. Give several glasses of water to dilute; do not induce vomiting. If stomach upset occurs, consult physician.
- Inhalation:** Non-toxic. Exposures to concentrate-mist may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.
-

V. FIRE FIGHTING MEASURES

Simple Green® is stable, not flammable, and will not burn.

Flash Point/Auto-Ignition:	Not flammable.
Flammability Limits:	Not flammable.
Extinguishing Media:	Not flammable/nonexplosive. No special procedures required.
Special Fire Fighting Procedures:	None required.
-

VI. ACCIDENTAL RELEASE MEASURES

Recover usable material by convenient method; residual may be removed by wipe or wet mop. If necessary, unrecoverable material may be washed to drain with large quantities of water.

VII. HANDLING, STORAGE & TRANSPORT INFORMATION

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

UN Number: Not required

Dangerous Goods Class: Non-hazardous

VIII. EXPOSURE CONTROLS

Exposure Limits: The Simple Green® formulation presents no health hazards to the user when used according to label directions for its intended purposes. Mild skin and eye irritation is possible (please see Eye contact and Skin contact in Section IV.).

Ventilation: No special ventilation is required during use.

Human Health Effects or Risks from Exposure: Adverse effects on human health are not expected from Simple Green®, based upon twenty years of use without reported adverse health incidence in diverse population groups, including extensive use by inmates of U.S. Federal prisons in cleaning operations.

Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate-mist.

Simple Green® is not likely to irritate the skin in the majority of users. Repeated daily application to the skin without rinsing, or continuous contact of Simple Green® on the skin may lead to temporary, but reversible, irritation.

Medical Conditions Aggravated by Exposure: No aggravation of existing medical conditions is expected; dermal sensitive users may react to dermal contact by Simple Green®.

IX. PERSONAL PROTECTION

Precautionary Measures:	No special requirements under normal use conditions.
Eye Protection:	Caution, including reasonable eye protection, should always be used to avoid eye contact where splashing may occur.
Skin Protection:	No special precautions required; rinse completely from skin after contact.
Respiratory Protection:	No special precautions required.
Work and Hygienic Practices:	No special requirements. Wash or rinse hands before touching eyes or contact lenses.

X. PHYSICAL AND CHEMICAL PROPERTIES

Appearance/odor:	Translucent green liquid with characteristic sassafras odor.		
Specific Gravity:	1.0257	Vapor Pressure:	17 mm Hg @ 20 °C; 22 mm Hg @ 25 °C
pH of concentrate:	9.5	Vapor Density:	1.3 (air = 1)
Evaporation:	>1 (butyl acetate = 1)	Density:	8.5 lbs./gallon
Boiling Point:	110 °C (231 °F)		
Freezing Point:	-9 °C (16 °F) If product freezes, it will reconstitute without loss of efficacy when brought back to room temperature and agitated.		
VOC Composite Partial Pressure:	0.006 mm Hg @ 20 °C		
Volatile Organic Compounds (VOCs):	7.96 g/L per ASTM Method 3960-90. Per California AQMD's VOC test method, product must be diluted at least 4 parts of water to 1 part Simple Green® in order to meet SCAQMD Rule 1171 & Rule 1122 and BAAQMD Regulation 8-16 VOC requirements for solvent cleaning operations.		
Water Solubility:	Completely soluble in water. The higher salt concentrations in marine ecosystems will lead to complexes with Simple Green® that may become visible at ratios above one part Simple Green® to 99 parts seawater.		
Ash Content:	At 600 °F: 1.86% by weight.		
Nutrient Content:	Nitrogen: <1.0% by weight (fusion and qualitative test for ammonia). Phosphorus: 0.3% by formula. Sulfur: 0.6% by weight (barium chloride precipitation method).		

Detection: Simple Green® has a characteristic sassafras odor that is not indicative of any hazardous situation.

XI. STABILITY AND REACTIVITY INFORMATION

Nonreactive. Simple Green® is stable, even under fire conditions, and will not react with water or oxidizers. Hazardous polymerization will not occur.

XII. TOXICOLOGICAL INFORMATION

Nonhuman Toxicity**Acute Mortality Studies:**

Oral LD₅₀ (rat): >5.0 g/kg body weight // Dermal LD₅₀ (rabbit): >2.0 g/kg body weight

Dermal Irritation: Only mild, but reversible, irritation was found in a standard 72-hr test on rabbits. A value of 0.2 (non-irritating) was found on a scale of 8.

Eye Irritation: With or without rinsing with water, the irritation scores in rabbits at 24 hours did not exceed 15 (mild irritant) on a scale of 110.

Subchronic dermal effects: No adverse effects, except reversible dermal irritation, were found in rabbits exposed to Simple Green® (up to 2.0 g/kg/day for 13 weeks) applied to the skin of 25 males and 25 females. Only female body weight gain was affected. Detailed microscopic examination of all major tissues showed no adverse changes.

Fertility Assessment by Continuous Breeding: The Simple Green® formulation had no adverse effect on fertility and reproduction in CD-1 mice with continuous administration for 18 weeks, and had no adverse effect on the reproductive performance of their offspring.

XIII. BIODEGRADABILITY AND ENVIRONMENTAL TOXICITY INFORMATION

Biodegradability:

Simple Green® is readily decomposed by naturally occurring microorganisms. The biological oxygen demand (BOD), as a percentage of the chemical oxygen demand (COD), after 4, 7, and 11 days was 56%, 60%, and 70%, respectively. Per OECD Closed Bottle Test, Simple Green® meets OECD and EPA recommendations for ready biodegradability.

In a standard biodegradation test with soils from three different countries, Butyl Cellosolve reached 50% degradation in 6 to 23 days, depending upon soil type, and exceeded the rate of degradation for glucose which was used as a control for comparison.

Environmental Toxicity Information:

Simple Green® is considered practically non-toxic per EPA's aquatic toxicity scale. Simple Green® is non-lethal to any of the marine and estuarine test animals listed in the following table at concentrations below 200 mg/L (0.02%). This table shows the Simple Green® concentrations that are likely to be lethal to 50% of the exposed organisms.

	LC₅₀ in mg/L (ppm)	
	48-hour	96-hour
Marine Fish:		
Mud minnow (<i>Fundulus heteroclitus</i>)	1690	1574
Whitebait (<i>Galaxias maculatus</i>)	210	210
Marine/Estuarine Invertebrates:		
Brine Shrimp (<i>Artemia salina</i>)	610	399
Grass Shrimp (<i>Palaemonetes pugio</i>)	270	220
Green-lipped Mussel (<i>Perna canaliculus</i>)	220	220
Mud Snail (<i>Potamopyrgus estuarinus</i>)	410	350

XIV. DISPOSAL CONSIDERATIONS

Simple Green® is fully water soluble and biodegradable and will not harm sewage-treatment microorganisms if disposal by sewer or drain is necessary. Dispose of in accordance with all applicable local, state, and federal laws.

XV. OTHER INFORMATION

Containers:	Simple Green® residues can be completely removed by rinsing with water; the container may be recycled or applied to other uses.
Electrical Wiring Compatibility:	Polyimide insulated wiring is not affected by exposure to Simple Green®. After immersion in Simple Green® for 14 days at 74°F, the 61 cm piece of polyimide insulated wire passed a one minute dielectric proof test at 2500 volts (ASTM D-149).
Contact Point:	Sunshine Makers, Inc., Research and Development Division: 562-795-6000.

***** NOTICE *****

All information appearing herein is based upon data obtained by the manufacturer and recognized technical sources. Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of this information, Sunshine Makers, Inc. or its distributors extends no warranties, makes no representations and assumes no responsibility as to the suitability of such information for application to purchaser's intended purposes or for consequences of its use.



NEW YORK STATE ELECTRIC & GAS CORPORATION

FIELD SAMPLING PLAN

**FORMER CLARK STREET
MANUFACTURED GAS PLANT
AUBURN, NEW YORK**

OCTOBER 2004

Prepared For:

**NYSEG
KIRKWOOD INDUSTRIAL PARK
BINGHAMTON, NEW YORK**

Prepared By:

URS

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1.0 INTRODUCTION

On behalf of NYSEG (New York State Electric and Gas), URS Corporation – New York (URS), has prepared this *Field Sampling Plan (FSP)* for the Supplemental Remedial Investigation (SRI) program at NYSEG's Former Clark Street Manufactured Gas Plant (MGP) site in Auburn, New York. The New York State Department of Environmental Conservation's (NYSDEC's) identification code for the site is 7-06-008.

This *FSP* has four sections. Section 2.0 includes a description of field procedures that will be used to implement the tasks outlined in the *Supplemental Remedial Investigation Work Plan (SRI Work Plan)* dated October 2004 and subsequent work plans submitted by NYSEG and approved by the NYSDEC. Section 3.0 describes sample handling procedures. Section 4.0 is a list of references used to prepare this *FSP*. Copies of field forms that will be used can be found in Attachment A. Copies of field equipment manuals are included as Attachment B. Bedrock coring procedures are in Attachment C.

2.0 SAMPLING PROCEDURES

The scope of work for the field investigation of the SRI at the site will consist of the following:

- Collection of surface soil samples;
- Advancement of soil borings;
- Collection of subsurface soil samples;
- Installation and development of overburden monitoring wells;
- Installation and development of shallow bedrock monitoring wells;
- In-situ hydraulic conductivity testing of monitoring wells;
- Collection of groundwater samples from existing and newly installed monitoring wells;
- Excavation of test trenches;
- Collection of surface water samples;
- Collection of sediment samples; and
- Sediment probing in the Owasco Lake Outlet.

The remainder of this section describes the procedures that will be followed to complete these tasks.

Non-aqueous phase liquids (NAPLs) may be encountered during various phases of this SRI, specifically during drilling of soil borings, monitoring well installations, and test trench excavations. The specific response or alteration to the task will be contingent upon several factors, including, but not limited to, the depth at which NAPL is encountered, the location of the NAPL relative to building structures or confining units, the amount or nature of NAPL encountered, and the goal of the task. Potential response scenarios may include installing a well that screens the impacted area (i.e., NAPL well), casing off the impacted zone and resuming the boring or well installation below the impacted area, abandoning and relocating the boring or well, or proceeding as normal with the task. Overburden monitoring wells that are to be NAPL recovery wells will be completed with a two-foot long riser with a bottom cap (installed into rock) below the PVC well screen to serve as a sump for NAPL recovery. The sump will be sealed to the borehole by bentonite, to prevent any NAPL accumulation outside of the sump. If it is determined that a monitoring well is needed below

an identified zone of NAPL or MGP residuals in soil, the potential for downward NAPL migration will be mitigated by casing the off the impacted zone by grouting a four-inch diameter steel casing to the borehole and completing the well with two-inch PVC well materials with a two-foot long sump thereby installing a double-cased well. The response will be coordinated with URS, NYSEG, and NYSDEC in a way that meets the overall objectives of this SRI, which is to define the nature and extent of contamination at the site.

2.1 MANUAL COLLECTION OF SURFACE SOIL SAMPLES

Surface soil samples (0 to 1-foot below ground surface) may be collected using hand augers or stainless-steel trowels. In some cases, the surface soil samples will be collected from two-inches beneath the vegetative cover. The following section describes the equipment and procedures for soil sample collection with a hand auger or stainless-steel trowel.

EQUIPMENT:

- Hand auger with stainless-steel scoop or stainless-steel hand trowel;
- Clean, airtight soil sampling jars to store samples;
- Photo-ionization detector (PID); and
- Field soil boring log or field notebook.

The trowel or hand auger will be decontaminated, examined for cleanliness, and checked for defects or any need of repair. Decontamination procedures are described in Section 2.10. A description of the sampling area from which the sample is being taken, and other pertinent sample information will be recorded on a field soil boring log or in a field notebook.

PROCEDURES:

Scoop up sample with trowel and put into the sample jars. If using a hand auger, scoop sample from auger into the sample jars using a trowel. If the soil will be analyzed for volatile organic compounds

(VOCs), an aliquot of soil will be immediately transferred into the VOC sample containers. The VOC sample containers will be completely filled in order to minimize headspace in the containers. A second aliquot of soil will be immediately retained for headspace analysis using a PID. The remaining sample containers will then be filled (grab samples).

Calibration of the PID and more detailed headspace analysis procedures are described in Section 2.2.3. The rationale behind this sequence of procedures (i.e., collecting a sample first, and then screening) is to minimize the loss of VOCs from samples that will be sent to a laboratory for analysis.

If a homogenized sample is needed for non-volatile constituent analysis, additional soil will be placed in a clean stainless-steel bowl. After removal of any stones, large twigs, or other vegetation, the sample will be thoroughly homogenized by mixing the sample in the bowl with a stainless-steel spoon. The sample will then be quartered in the bowl and each quarter then will be mixed separately, before finally mixing the entire sample again. The sample will then be placed in sample containers using a trowel for non-volatile constituent analysis. This type of sample, defined as a homogenized sample, will not be analyzed for VOCs.

The field observations and sample details will be recorded on a field soil boring log or in a field notebook. Sample labels will be filled out away from the sample bottles whenever possible. All soil sample locations will be marked on the ground. Identification materials and markings, that will last until the end of the project, will be used.

To prevent cross-contamination of samples, the field personnel will wear disposable gloves when collecting and handling samples. The gloves will be changed between samples. The hand augers and stainless-steel hand trowels will be decontaminated between samples.

2.2 SUBSURFACE SOIL SAMPLING PROCEDURES

Soil borings will be advanced and overburden soil samples will be obtained continuously to the bedrock surface to verify the geologic profile and assure proper placement of the well screens. Subsurface soil samples may be collected using MacroCoreTM discrete samplers with a direct push drill rig, or using split-spoon samplers during drilling with a conventional drill rig, and during test trench excavations.

Field Equipment

Some or all of the following equipment will be used during soil sampling:

- Field boring log sheet and field notebook;
- Photo-ionization detector (PID);
- Stainless-steel knife, trowels, spoons, scoops, and bowls;
- Personal protective equipment (PPE);
- Disposable gloves;
- Distilled/deionized water;
- Cleaning detergents and decontamination chemicals;
- Five-gallon pails for decontamination;
- Brushes;
- Sample bottles;
- Cooler;
- Sufficient ice or freezer packs to maintain the samples at four degrees Celsius; and
- Chain of Custody (COC) forms.

2.2.1 Soil Sampling Using Direct Push Drilling Equipment

Discrete samplers will be used to collect samples obtained with a direct push (Geoprobe™) drill rig. These samplers have an open tube design and measure approximately two-inches in diameter (outer) by 44-inches long. The samplers will be fitted with a removable cutting shoe. The sampler will be advanced to the desired depth. Each of the samplers will be fitted with a new acetate liner prior to collection of a sample. The acetate liner will be split open to collect the soil. The soil samples from the zero to four foot below ground surface (bgs) interval will be collected using MacroCore™ open samplers. Soil samples collected deeper than four feet bgs will be collected using the MacroCore™ equipped with a discrete sampling device. This device prevents any collapsed material from entering the sampler.

The length of sample recovery, percent recovery, and soil description, including odors, will be recorded on the boring log. A copy of a field boring log sheet is provided in Attachment A.

Immediately upon retrieval of the sampler, an aliquot of soil will be transferred to the VOC sample containers. The VOC sample containers will be completely filled in order to minimize headspace in the containers. The filled VOC sample container will be placed in a cooler with sufficient ice to maintain a temperature of 4 degrees Celsius.

A second aliquot of soil from the sampler will be retained for headspace analysis using a PID. Headspace analysis procedures are described in Section 2.2.3. The rationale behind this sequence of procedures (i.e., collecting a sample first, and then screening) is to minimize the loss of VOCs from samples that will be sent to a laboratory for analysis.

The remaining soil will be placed in a clean stainless-steel bowl. After removal of any stones, large twigs, or other vegetation, the sample will be thoroughly homogenized by mixing the sample in the bowl with a stainless-steel spoon. The sample will then be quartered in the bowl and each quarter will be mixed separately, before finally mixing the entire sample again and placing it in containers for non-volatile constituent analysis.

Field personnel will wear disposable nitrile gloves for the collection and handling of all samples and the disposable gloves will be changed between each sample. A stainless-steel scoop or trowel may be used to fill the sample containers.

The samples will be packed into sample coolers containing sufficient bags of ice or freezer packs to maintain the samples at 4 degrees Celsius.

All acetate liners will be discarded after use. Upon completion of sampling at each location, all sampling equipment will be decontaminated in accordance with the procedures described in Section 2.10. Quality assurance samples, including duplicate samples, equipment rinseate blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.9 and the *QAPP*. The sample custody procedures are described in Section 3.0.

2.2.2 Soil Sampling Using Split-Spoons

Soil samples will be collected using two-inch diameter by two-foot long split-spoons in accordance with ASTM D-1586-84: *Standard for Penetration Test and Split-Barrel Sampling of Soils*. The split-spoons will be driven into the overburden materials using a 140-pound hammer-drop system until the desired depth of the boring is reached. The blow counts for each six-inch increment of penetration will be recorded on the boring log. The hollow stem augers (HSAs) will be advanced two feet after each split spoon is collected to avoid borehole cave-in. Furthermore, a plug inside of the HSAs will be advanced during drilling. The soil samples obtained from the split-spoon samplers will be collected and handled in a similar manner as the soil samples obtained from MacroCore™ samplers, described in Section 2.2.1.

Upon completion of sampling at each location, all sampling equipment will be decontaminated in accordance with the procedures described in Section 2.10. Quality assurance samples, including duplicate samples, equipment rinseate blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.9 and the *QAPP*. The sample custody procedures for the soil samples are described in Section 3.0.

2.2.3 Headspace Analysis Procedures

Field screening of collected soil samples will be completed using headspace analysis using a photo ionization detector (PID) equipped with a 10.6 electron volt (eV) lamp to detect the presence of VOCs. The calibration procedures for the Thermo Environmental Instruments Inc., Model 580B organic vapor meter are provided in Attachment B of this FSP.

Immediately upon retrieval of a soil sample, two aliquots of soil will be collected. One aliquot will be used to completely fill the VOC sample containers and the second aliquot will be used for headspace analysis using a PID. The rationale behind this sequence of procedures (i.e., collecting a sample first, and then screening) is to minimize the loss of VOCs from samples that will be sent to a laboratory for analysis.

The soil to be used for headspace analysis will be placed in new sealable polyethylene bags. Each bag will be labeled with the location, depth interval, and date of the soil sample. The soil will be allowed to warm to ambient temperature to allow the vapors in the soil to equilibrate with the air in the bag. If ambient temperature is less than 68° Fahrenheit (i.e., room temperature) the samples may be placed indoors to allow the soil to warm to room temperature. A measurement will be collected by inserting the probe of the PID through an opened corner of the bag. Care will be taken to avoid uptake of water droplets and soil particles. The highest meter response will be recorded as the headspace concentration. Each PID measurement will be recorded on the appropriate soil boring log or in a field notebook.

2.3 MONITORING WELL INSTALLATION PROCEDURES

This section describes the procedures that will be used to install monitoring wells using a drill rig. The procedures described in this section will provide monitoring wells that will:

- Provide reliable stratigraphic information about penetrated soils and bedrock;

- Provide representative samples of groundwater for analysis;
- Permit collection of representative water level data; and
- Effectively isolate the separate hydrogeologic strata penetrated during drilling.

Some or all of the following equipment will be used during monitoring well installations:

- Drilling rig, drilling tools, and support truck with water tanks;
- Sheet of plywood, or mud box;
- Core boxes;
- Steam cleaner;
- Tremie pipe;
- Threaded polyvinyl chloride (PVC) well risers and screens with a minimum wall thickness of Schedule 40 and screen slot sizes of 0.010-inch and 0.020-inch;
- PVC or steel well caps and bottom plugs;
- Washed Morie No. 0 or equivalent quartz sand for filter pack with 0.010-inch slot screen;
- Washed Morie No. 1 or equivalent quartz sand for filter pack with 0.020-inch slot screen;
- Portland cement, Type I or II;
- Bentonite pellets;
- Powdered bentonite;
- Protective casings and/or roadboxes and padlocks;
- Concrete mix for surface completions;
- Polyethylene sheeting; and
- Field notebook, soil boring logs, and well construction logs.

2.3.1 Drilling, Borehole Logging, Well Installation, and Construction

All necessary drilling/well permits (if applicable) and utility clearances for NYSEG and non-NYSEG utilities will be obtained prior to the start of drilling operations. All drill rigs will use necessary tools, supplies, and equipment, which will be supplied by the drilling subcontractor. The drill crew will consist of a NYS-licensed and experienced driller and one or more driller's assistants.

Appropriate URS personnel will be onsite to supervise the drill crew and for logging the soils and sampling. Drilling subcontractor personnel will transport water to the rigs, clean tools, assist in the installation of security and marker pipes, construct the concrete aprons, and may develop the wells.

The supervising field geologist will properly log all soil boring and well construction details. All notes will be entered on a standard boring log sheet (Attachment A) or field book. The following information will be recorded on the boring log sheet: project name and number, boring or well number and location, drilling contractor, drilling method and equipment, sampling method and equipment, start and finish time and date, and name of the supervising field geologist.

Supplies and equipment will be transported to the lay-down area designated onsite. Before moving onto the first well location, all reusable drilling equipment and tools will be steam-cleaned at a designated onsite decontamination station using a portable steam cleaner. Decontamination procedures are provided in Section 2.10.

During the advancement of the soil boring standard penetration tests will be performed in accordance with ASTM D-1586-84: *Standard for Penetration Test and Split-Barrel Sampling of Soils*. Soil sampling procedures, including field screening of the soil samples using headspace analysis are described in Section 2.2.3.

At each boring location, drilling will be conducted through a mud box or at a minimum a sheet of plywood with a hole cut through the center to contain the drill cuttings. Hollow stem augers (HSA) will be used to drill through the overburden materials. A plug will be lowered to the bottom of the HSA drill string (inside of the HSAs) and advanced with the HSAs during drilling, this plug will be removed during soil sample collection.

Overburden Monitoring Well Construction

Shallow monitoring wells will be installed in the unconsolidated material by using continuous-flight, 4.25-inch diameter (or larger as necessary) inner diameter (ID) HSAs for two-inch wells.

URS onsite personnel will prepare a soil boring log and a time log of significant events during each working day. The soil boring logs will be used to record field classification of soils, sampling types and number of samples, sampling depths, first encountered and static groundwater levels, progress of drilling, final completion depth, and the nature and resolution of any problems encountered. The Unified Soil Classification (USC) System will be used for soil descriptions. The information recorded on well construction logs will be used to create computer-generated soil boring and well construction logs for each boring location for inclusion in the *SRI Report*.

After the boring is drilled to the required depth, a string of two-inch, flush-threaded, new PVC well riser and screen will be installed through the HSAs. A threaded bottom plug will be placed in the bottom of the screen and the top of the well will be protected with a vented cap. The wells will be set at the desired horizon of the overburden materials with appropriate changes in screen length, if necessary. In general, the lengths of the monitoring well screens will be five to 15 feet. The well riser will be of sufficient length to extend from the top of the screen to approximately six inches below grade for wells to be completed as flush-mount wells. If the well is to be completed above grade, the well riser will be of sufficient length to extend from the top of the screen to approximately two to three feet above the ground surface. At this time, we anticipate that the new monitoring wells will be completed as flush-mount wells.

Two- inch diameter schedule 40 PVC screens and risers will be used for all overburden monitoring wells unless significant amounts of NAPL are observed in the soil during drilling. However, if significant amount of NAPLs is observed in the soil, larger, four-inch or six-inch diameter well, and possibly steel construction will be considered to allow for more efficient NAPL recovery. Furthermore, a two-foot long riser with a bottom cap (installed into rock) will be installed below the well screen to serve as a sump for NAPL recovery at all locations that are suspected to contain

NAPLs, based on soil borings. The sump will be sealed to the borehole by bentonite, to prevent any NAPL accumulation outside of the sump.

The screen slot size will be determined by the URS personnel supervising the well installation based on the visual inspection of particle size of the material to be screened. The screen slot size (0.010- or 0.020-inch) and appropriate sand pack materials will be chosen to adjust for grain size variations in the formation.

If fine-grained sand and silt are present in the screened interval, a 0.010-inch slot size screen will be used, otherwise a 0.020-inch slot size screen will be used for the coarser formation material. Washed Morie No. 0 or equivalent sand will be used for 0.010-inch slot screens. Washed Morie No. 1 or equivalent sand will be used for 0.020-inch slot screens.

For all well locations that are suspected to contain NAPLs, a 0.040-inch slot size screen will be used. A fine gravel sand pack will be used for 0.040-inch slot screens.

If groundwater conditions permit, the top portion of the shallow well screens will be set approximately two feet above the water table to detect light nonaqueous phase liquids (LNAPLs) such as petroleum products (if any) and to allow for observations of seasonal water level fluctuations.

URS will mark a survey reference point on the top of the well riser. Water level recordings will be made with respect to this reference mark. All risers and screens will be wrapped in plastic during transport to the site and prior to installation in the borehole.

A sand pack will be installed around well screen to a depth extending two to three feet above the top of the screen. During installation of the sand pack, the augers will be withdrawn in small increments so as to avoid disturbing the sand pack. URS field personnel will record the amount of sand used. A weighted fiberglass tape will be used to measure the top of the sand pack and detect bridging of the sand pack material. If bridging is detected it will be corrected prior to the addition of more filter

pack material. If a two-foot long PVC sump is installed into the weathered bedrock at an overburden monitoring well due to the presence of dense non-aqueous phase liquid (DNAPL) in the soil, then the sump will be sealed to the borehole with bentonite. The bentonite seal will prevent any DNAPL from the weathered bedrock to preferentially migrate and collect around sump in the weathered bedrock.

A 24-inch thick (minimum) seal of bentonite pellets will be placed over the sand pack and hydrated. For shallow monitoring wells, where the top of the screen is above the water table, hydration of the bentonite clay pellets will be accomplished using distilled or potable water.

A bentonite-cement grout consisting of approximately seven pounds of powdered bentonite per 94-pound sack of Portland cement, and not more than six gallons of clean water per 94-pound sack of cement, will be introduced into the borehole annular space by injection under pressure using a tremie pipe. The grout must be allowed to set and cure for at least 48 hours before commencing well development or other activities, which might disturb the seal.

Bedrock Drilling Procedures

Installation of monitoring wells will require drilling into bedrock. The following procedures will be followed during bedrock drilling. Prior to drilling into the bedrock, it will be necessary to seal off the overburden materials with a casing to prevent any cross contamination from the overburden and to provide a pathway for water circulation during bedrock drilling. This is achieved by grouting a permanent casing into a socket in the bedrock surface.

After the soil sampling is completed the HSAs will be removed from the ground leaving a pilot hole for the overburden casing. The driller will then drive 6-inch inside diameter steel casing to the top of bedrock. The 6-inch casing will be hammered into the bedrock surface a sufficient distance to provide a seal. Next, the driller will set up a circulation tub and wash the material inside of the casing out with a 5 7/8-inch diameter roller bit. The roller bit will be advanced approximately five feet into bedrock to create a rock socket for the permanent casing.

Following the drilling of the rock socket, the driller will add a cement bentonite grout mixture to the borehole using tremie pipe. While adding the grout, the bottom of the tremie pipe will be positioned no more than one foot from the bottom of the rock socket. A minimum of one gallon of grout per foot of borehole will be added.

The driller will then lower a 4-inch diameter schedule 40 PVC flush thread casing with a bottom cap to the borehole. Any fluids displaced while lowering the casing will be containerized and temporarily stored onsite for later offsite disposal. The driller will then remove the 6-inch casing and top off the annular space between the 4-inch casing and the borehole wall with grout.

After the grout has been allowed to cure for a minimum of 24 hours, drilling activities can resume. The bedrock will be drilled using NX bedrock coring tools. Drilling water will be recirculated to minimize the volume of wastewater generated.

For the shallow bedrock wells, core samples will be collected to a total depth of ten feet bedrock beyond the bottom of the overburden casing. After completion of bedrock coring, the NX borehole will be reamed using a nominal 4-inch diameter roller bit. The shallow bedrock wells are anticipated to be completed as open hole wells.

The onsite geologist will record the following observations during the bedrock coring: drilling rate, circulation water loss or gain, loss of circulation and any signs of MGP indicators or any other potential signs of contamination. Attachment C further describes the bedrock core logging procedures.

In areas specified by the client, the new monitoring wells will be completed with protective stickup risers or flushmount roadboxes. For stickup wells, a six-inch by five-foot steel outer protective riser with a hinged, lockable cover will be installed in the grout to a depth of 2.5 feet and equipped with a padlock. For flush-mount wells, an eight-inch steel protective cover with water-tight seal will be installed in the grout. The integrity of the well will be protected with a new, lockable, sealing,

vented well cap with an expandable O-ring, which forms an air-tight seal. All locks will be keyed alike.

For stickup wells, the drilling subcontractor will construct a (2 feet x 2 feet x 0.5 foot) concrete apron around each well. Concrete aprons will be sloped to promote runoff away from the well. Concrete pads may be constructed within three days after wells have been installed. Four-inch diameter steel guard posts or ballards may be installed around the pads, if required by the client. The posts will have a minimum stickup of 2.5 feet above ground surface. For the flush-mount wells, the space around the flush-mount road box will be filled with concrete and sloped to promote runoff away from the well.

Quality Control Requirements for drilling are described below. Drilling procedures will:

- Prevent cross-contamination;
- Minimize the disruption of existing conditions;
- Minimize long-term impacts to adjacent water-bearing zones; and
- Ensure worker safety.

Cuttings will be containerized in Department of Transportation (DOT) approved 55-gallon drums and disposed of in accordance with all relevant regulations. Drilling fluids will also be containerized for off-site disposal. The drums will be labeled and staged on-site.

Drilling tools will be steam cleaned between each drilling location to prevent cross-contamination. Decontamination will be performed on the temporary decontamination pad that will be constructed in an area specified by the client. Split-spoon samplers may be cleaned near the drilling rig, in a designated area equipped with large buckets or other containers capable of containing the decontamination water. All decontamination water will be subsequently containerized for proper off-site disposal.

2.3.2 Well Development

This section describes the groundwater well development procedures and quality control requirements.

EQUIPMENT:

- Centrifugal Submersible or Waterra inertial pump;
- High density polyethylene (HDPE) tubing;
- Foot valves;
- Generator and extension cords;
- ASTM Type II or analyte-free distilled water;
- Water level indicator;
- Five-gallon bucket;
- Polyethylene sheeting; and
- Well development record and field notebook.

Well development will begin no sooner than 48 hours after grout placement and will be accomplished through a combination of surging and high volume pumping using a submersible, centrifugal or Waterra pump. The position of the pump intake will be raised and lowered across the screened interval or open hole to remove sediment and drilling fluids from the sand pack and or bedrock.

Development will continue until a minimum of three well volumes have been removed and the discharged water contains no visible particles or turbidity, or until the well is pumped dry. Well development procedures will be documented in the field notebook or on a well development record.

The development water from each well will be containerized and stored on-site in DOT-approved 55-gallon drums or a holding tank for later off-site disposal in accordance with all relevant regulations by NYSEG.

2.3.3 Well Surveying

A New York licensed surveyor, using a United States Geodetic Survey benchmark as a datum, will survey the locations and elevations of all new wells. NYSEG will provide surveying services for this project. The geographic location or horizontal survey measurement will also be surveyed to an accuracy of one foot.

A reference point will be marked on the top of the well riser at the time of construction. The elevation of the well riser will be surveyed to the reference point, and all future water level recordings will be made with respect to the reference point. The elevation of the reference mark at the top of the well riser on all monitoring wells will be surveyed to the nearest 0.01 foot. The ground elevation at the base of each well will also be surveyed to an accuracy of 0.1 foot.

The surveyor will provide tabular summaries of the vertical elevations and horizontal coordinates of the boring locations, benchmarks, and other reference points as specified in the work plan. The survey data will be used to update the existing base map that depicts boring locations, samples, and other reference points.

2.3.4 Slug Testing of Monitoring Wells

Slug testing is a rapid and inexpensive procedure for estimating the horizontal hydraulic conductivity of an aquifer material (bedrock) screened by a monitoring well. Equipment consists of a nylon rope, a decontaminated slug, a pressure transducer, a data logger, laptop computer with appropriate software, and a water level indicator. Slug tests will be performed on newly-installed monitoring wells only.

Falling Head Test Procedure:

- Record the initial water level in the well (static water level);
- Lower the pressure transducer/data logger into the well to the well bottom. Pull the transducer up one foot and secure it;

- Connect the transducer/data logger to the laptop computer, and begin monitoring the water level with the computer;
- Insert a slug into the well above the water table, with nylon rope;
- Begin a testing event on the computer and quickly lower the entire slug into the water column and secure it;
- Allow the water level in the well to return to static condition by monitoring with the computer;
- When the water level has returned to the static level, stop the testing event and save the data.

Rising Head Test Procedure:

- With the slug in the water column and the water level at static level, begin a new testing event on the computer;
- Remove the slug from the water column quickly by pulling up on the nylon rope;
- Allow the water level in the well to return to static condition;
- Stop the testing event and save the data;
- Review the data briefly to verify that the slug test was successful.

2.4 GROUNDWATER SAMPLING PROCEDURES

Prior to each groundwater sampling event, all new wells and existing wells will be gauged. The upgradient and background wells will be purged and sampled before downgradient wells.

Well purging and groundwater sampling procedures that will be followed at the site to obtain representative groundwater samples from the existing wells, and proposed monitoring wells are described below. Some or all of the following equipment will be used to collect groundwater samples:

- Sampling and purging logs;
- Submersible pump;

- Pre-cleaned submersible pump with controls (bedrock well sampling);
- New or dedicated polyethylene tubing;
- New or dedicated foot-valve;
- Personal protective equipment (PPE);
- Disposable gloves;
- Distilled/deionized water;
- Cleaning detergents for decontamination;
- Five-gallon pails for decontamination;
- Brushes;
- Laboratory-supplied sample bottles;
- Coolers;
- Sufficient ice or freezer packs to maintain the samples at four degrees Celsius; and
- Chain of Custody (COC) forms.

2.4.1 Well Purging and Stabilization

The static groundwater level will be measured at each well prior to purging or sample collection. An electronic water level indicator will be used to measure the depth to water surface from the well measuring point to the nearest 0.01-foot.

Purging procedures have a great influence on the reliability of groundwater samples, and inconsistent purging can be a source of variability among groundwater analyses. Therefore, purging procedures will be standardized as much as possible as described below. Once a specific purging procedure has been used and found suitable for a well, the same procedure will be used in subsequent purging events, when possible. We anticipate the use of submersible pumping equipment for overburden well purging and sampling. For bedrock well purging and sampling we anticipate using a submersible Grundfos Redi FloII™ or equivalent. The purge water from each well will be containerized and stored on-site in DOT-approved 55-gallon drums or a holding tank for later off-site disposal in accordance with relevant regulations by NYSEG.

Upgradient wells, background wells, and other wells that are considered to be relatively uncontaminated, based on available data, will be purged and sampled first, whenever feasible. This practice is intended to minimize the potential for cross-contamination from more contaminated wells.

All wells will be purged before sampling. Water will be purged and sampled from each well using USEPA-approved low flow sampling guidelines. The pump will be operated at a discharge rate of less than one liter per minute. The purging rate will be maintained at a rate sufficient to prevent drawdown in excess of ten percent of the standing water column. If drawdown cannot be maintained at less than ten percent of the standing water column, then the condition will be noted. The intake of the pump or tubing will be set at the midpoint of the well screen or open hole.

During purging, field personnel will monitor temperature, pH, specific conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity using a multi-parameter meter connected to an in-line flow-through cell. A water level reading will also be collected in conjunction with water quality parameters. Water quality parameters will be recorded at 3 to 5 minute intervals during purging. Samples will be collected following a minimum of 30 minutes of purging and once parameters have stabilized over three recording intervals. The following criteria will dictate parameter stabilization:

- pH within 0.10 SU
- Specific Conductivity within 10%
- DO within 10%
- Turbidity within 10%
- ORP within 10 mV

In addition, field personnel will obtain a ferrous iron measurement at each monitoring well using an approved field ferrous iron test kit. The aliquot to be analyzed for ferrous iron will be collected after the physiochemical parameters have stabilized. Ferrous iron measurements will be recorded on the groundwater sampling data sheet.

All water quality instruments will be calibrated according to manufactures specifications on a daily basis. Calibration procedures for the water quality monitoring equipment are provided in Attachment B.

2.4.2 Groundwater Sampling Procedures

This procedure describes steps involved in collecting groundwater samples using dedicated tubing and a submersible or peristaltic pump. The objectives of the activities covered by this procedure are to:

- Obtain groundwater samples for laboratory and field analysis;
- Ensure that the groundwater samples will be representative of actual groundwater quality;
- Ensure quality control and consistency during sampling; and
- Serve as a means to allow traceability of error(s) in sampling and data recording.

At wells that are not purged dry, groundwater sampling will commence immediately after purging without turning the pump off. The discharge hose will be disconnected or cut off from the flow-through cell prior to sampling to minimize cross-contamination.

Containers used for VOC analysis will be filled first by filling the vials from the bottom, which reduces air bubbles and minimizes agitation so as to prevent aeration. After the VOC vials are filled, then the remaining sampling containers will be filled in the following order: SVOCs, phenols, cyanide, and metals. At well locations where turbidity is greater than 50 NTUs then the groundwater samples for metals analysis will be field-filtered using a 0.45-micron (μm) in-line disposable filter. The aliquot for metals analysis will be preserved by adding a sufficient amount of concentrated nitric acid to maintain the sample at a pH of less than 2 standard units (SU).

The sample containers will be wiped dry and each sample container will be labeled. The sample number, date, time, location, depth, type of analysis, preservative, and sample collector's name will be recorded on the sample label. This information will also be recorded on the groundwater

sampling data sheet along with a description of the physical appearance of the sample including color, clarity, suspended solids, and odor.

The samples will be placed in coolers with sufficient bagged ice or ice packs to maintain a temperature of 4 degrees Celsius during shipment. Sample vials for VOC analyses will be placed in resealable plastic bags prior to placement in the coolers. Quality assurance samples, including duplicates, equipment rinse blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.9 and the *QAPP*. The sample custody procedures for the groundwater samples are described in Section 3.0.

All data relating to weather conditions, time of collection, sampling method, field observation, sample location, and analysis will be recorded on a field sampling record or field notebook. A copy of a field sampling record is provided in Attachment A.

2.5 EXCAVATION OF TEST TRENCHES

Test trenches will be excavated onsite in order to visually inspect the water table for evidence of contamination, if any, and to further characterize the stratigraphy. Also, the trenches will aid in determining the location of former piping connecting former MGP structures, which may act as conduits for contamination migration.

URS will obtain the services of an experienced trenching contractor. Before any trenching activities are begun, the trenching equipment will be steam cleaned to prevent cross contamination. Each trench will be excavated approximately 20 feet long and extend to just below the water table at a depth of approximately 4 feet bgs. If grossly contaminated soil is encountered in any of the test trenches, the soil will be left exposed for visual inspection and not excavated from the subsurface. Once the excavation is complete, URS personnel will make observations regarding the water table surface. Detailed field notes and a photo log will be recorded for each trench. The following information will be recorded: location of trench, approximate depth to water table from grade, total depth and length trench, stratigraphic changes observed on the trench walls, evidence of any

underground structures encountered and any signs of MGP indicators or other signs of contamination. A copy of the daily excavation form is provided in Attachment A.

Soil generated during excavation will be screened for organic vapors using a PID. One soil sample will be collected at each trench location from the area exhibiting the highest level of contamination. If no PID readings are observed the sample will be collected from the water table interface.

Following all necessary observations and sampling, the test trenches will be backfilled with the materials excavated. The area of each trench will be restored to the pre-excavation state.

2.6 OWASCO LAKE OUTLET CHARACTERIZATION AND SEDIMENT PROBING

A characterization and sediment probing program will be performed in the Owasco Lake Outlet to obtain data regarding sediment thickness, vertical profiles with respect to sediment composition and olfactory or visual evidence on impacts, if any, at transects upstream, adjacent to and downstream of the former MGP site. Field staff will also measure the flow velocity of the Outlet and install three staff gauges for water level data.

Transects will be performed by walking across the outlet on a line perpendicular to the stream flow while probing the bottom using a four-foot long fiberglass tile probe with a steel point. Transects will be spaced approximately 100' apart. The bottom of the stream will be probed at four approximately equidistant intervals with one probe near each bank at transects less than approximately 60-feet long. The bottom of the stream will be probed at five approximately equidistant intervals with one probe near each bank at transects greater than approximately 60-feet long.

Approximately eleven transects will be performed adjacent to the site, five transects will be performed upstream, and five transects will be performed downstream. In areas where no sediment is observed, cobbles and small boulders will be overturned. All observations of transect locations, sediment thickness, composition, and olfactory or visual evidence of impacts will be recorded in a

field notebook. Any sheens, tar or NAPL blebs, globules or any other indications of product will be noted in the logbook. Sediment thickness water depth and stream water velocity will be measured and noted.

In addition, a flow velocity measurement will be obtained using a stream flow meter and recorded. The flow rate will be measured from the approximate center of the Outlet at each transect.

Up to three staff gauges will be installed at locations upstream, adjacent to and downstream of the former MGP site. The staff gauges will be constructed of ½" diameter carbon steel reinforcement bar. Each gauge will be manually hammered into the sediment a sufficient distance so that it is secure. A point at the top of each staff gauge will be marked as the measuring point. The location and measuring point elevation will be surveyed. A depth to water measurement will be collected from each staff gauge on subsequent water level monitoring events.

Furthermore, a supplemental evaluation of the properties up to 0.5 miles upstream from the site along the Owasco Lake Outlet will be conducted. This reconnaissance will evaluate the current and historic character of these properties with respect to potential contribution of contamination to the Owasco Lake Outlet. During this evaluation, field staff will conduct visual observations of these properties, review historic aerial photographs, Sanborn maps, and other historic documents that may be available from the Cayuga County Historical Society and the City of Auburn. In addition, field observations will identify the locations of any other point source(s) such as storm sewer or other discharges, gas stations, etc.

2.7 SURFACE WATER SAMPLING PROCEDURES

Surface water samples will be collected using the following procedures:

Surface water samples from shallow depths can be collected by submerging the sample container below the water surface. If surface water samples are being collected in conjunction with sediment samples, the surface water samples will be collected first. Personnel collecting the samples will approach the sampling location from the downstream direction with the sample container pointed

upstream to ensure collection of an undisturbed water sample. Samples will be collected from the farthest downgradient location first and subsequent samples collected progressively upstream.

Quality assurance samples, including duplicates, equipment rinseate blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.9 and the *QAPP*. The sample custody procedures for the surface water samples are described in Section 3.0.

The following equipment will be used during surface water sample collection.

- Personal protective equipment (PPE);
- Disposable gloves;
- Distilled/deionized water;
- Cleaning detergents and decontamination chemicals;
- Five-gallon pails for decontamination;
- Brushes;
- Laboratory-supplied sample bottles;
- Cooler;
- Sufficient ice or freezer packs to maintain the samples at four degrees Celsius; and
- Chain of Custody (COC) forms.

All data relating to weather conditions, time of collection, sampling method, field observation, sample location, and analysis will be recorded on a field surface water sampling record or field notebook. Any sheens, tar or NAPL blebs, globules or any other indications of product will be noted in the logbook. A copy of a field surface water sampling record is provided in Attachment A.

2.8 SEDIMENT SAMPLING PROCEDURES

Sediment samples will be collected from the bottom of the surface water body. Some or all of the following equipment will be used to collect sediment samples:

- Field boring log sheet and field notebook;

- Photo-ionization detector (PID);
- Pre-cleaned stainless-steel hand auger;
- Pre-cleaned stainless-steel sediment corer with new disposable acetate liners;
- Stainless-steel knife, trowels, spoons, scoops, and bowls;
- Personal protective equipment (PPE);
- Disposable gloves;
- Distilled/deionized water;
- Cleaning detergents and decontamination chemicals;
- Five-gallon pails for decontamination;
- Brushes;
- Laboratory-supplied sample bottles;
- Cooler;
- Sufficient ice or freezer packs to maintain the samples at four degrees Celsius; and
- Chain of Custody (COC) forms.

If surface water samples are being collected in conjunction with sediment samples, the surface water samples will be collected first. Personnel collecting the samples will approach the sampling location from the downstream direction. Samples will be collected from the farthest downgradient location first and subsequent samples collected progressively upstream. Disposable gloves will be worn during collection and handling of the samples. The gloves will be changed between samples.

Sediment samples will be collected using a stainless-steel hand auger or a stainless-steel sediment corer with new disposable acetate or Lexan liners. The soft sediment will be probed up to a maximum depth of three feet or refusal. The core will be segmented into intervals of 0 to 0.5 feet, 0.5 to 1.0 feet, 1 to 2 feet, and 2 to 3 feet or increments defined in the field by notable changes in stratigraphy or contamination. The uppermost depth interval (0 to 0.5 feet) will be analyzed for the parameters noted in Table 8. The remaining core segments will be retained for potential analyses. The remaining core segments (greater than 0.5 feet) maybe analyzed if the 0 to 0.5 foot sample exhibits MGP impacts upon inspection in the field or if the laboratory analytical results from the 0 to

0.5 foot sample contains elevated concentration of MGP contaminants. Field observations including the type of sediment, staining, odors, and changes in material will be documented.

Sediment samples will be collected based upon the results of the sediment probing field effort. Samples will be collected from any areas where sheens are observed. Samples will be collected from outfall/discharge areas, sediment accumulation areas, and riffle/run areas upstream, adjacent to and downstream of the site. The sampling locations will be carefully selected after consultation with NYSEG and NYSDEC so that meaningful data are collected. Sampling depths will depend upon the sediment thickness and stratigraphic sequence. A total of ten samples are planned, however, the number of samples may be revised depending upon the results of the sediment probing field effort.

Quality assurance samples, including duplicates samples of the liquid and the solid samples, equipment rinseate blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.9 and the *QAPP*. Sampling equipment will be decontaminated following the procedures in Section 2.10. The sample custody procedures for the sediment samples are described in Section 3.0.

All data relating to weather conditions, time of collection, sampling method, field observation, sample location, and analysis will be recorded on a field sampling record or field notebook. A copy of a field sampling record is provided in Attachment A.

2.9 QUALITY ASSURANCE SAMPLES

As part of the quality assurance (QA) program, QA samples will be prepared and collected to provide control over the collection of environmental measurements and interpretation of the analytical data. Three types of QA samples will be prepared or collected: 1) duplicate samples; 2) field (equipment rinseate) blanks; and 3) trip blanks. Duplicate samples and field blanks will be prepared for all sampling parameters. Trip blanks will only be analyzed for VOCs when aqueous sampling for VOCs is conducted. The three types of QA samples are discussed in the following sections.

2.9.1 Duplicate Samples

The analysis of blind duplicate samples provides a means of evaluating the relative precision of the sample collection and analytical procedures. An important factor in evaluating the analytical data from sample pairs is the homogeneity of the analyte within the sample matrix. Therefore, whenever possible, the field personnel will homogenize an aliquot from a discrete location or interval before the sample and duplicate are collected. However, in order to prevent the loss of VOCs, VOC samples must never be homogenized. In general, the handling of VOC samples will be minimized to preserve the physical integrity of the VOC fraction. Duplicate samples will be prepared for each sample matrix at a rate of one duplicate per twenty samples. Duplicates will be designated as “DUP” followed by the six-digit date (i.e., DUPYYMMDD).

Duplicates of solid samples for VOC analysis will be obtained by alternately filling the sample containers for the sample and duplicate for VOC analysis with aliquots collected from the same discrete location or interval. Once samples for VOC analysis have been collected, the sample will be thoroughly homogenized. Following homogenization, the sample containers for the remaining parameters will be filled.

Duplicates of liquid samples will be obtained by alternately filling the sample and duplicate containers with aliquots of liquid collected with the same sampling device. VOC samples and duplicates will be collected first in order to minimize the potential for loss of VOCs. After the VOC samples are collected, any liquid remaining in the sampling device will be equally apportioned among all the sample containers. Upon retrieval of the next aliquot of liquid, the order in which the sample bottles are filled will change by one increment.

2.9.2 Equipment Rinseate Blanks

A field blank is used to test for potential contamination from ambient air. An equipment rinseate blank is used to test for potential contamination from sampling instruments used to collect and transfer samples from point of collection into sample containers. Field blanks will be collected at the

discretion of the project manager. If re-usable equipment is used, equipment rinseate blanks will be collected at a rate of one per 20 samples per matrix.

A field blank is prepared by filling a sample container with analyte-free water from the laboratory. This container is then opened and exposed to the ambient atmosphere in the most contaminated area of the site. After this exposure, the field blank container is sealed and the field blank is then handled, transported, and analyzed in the same manner as the other analytical samples. Field blanks will be denoted as “FB” followed by the six-digit date (i.e., FBYYMMDD).

Equipment rinseate blanks are prepared by passing laboratory-supplied analyte-free water (or the distilled/deionized water that is used for decontamination) through decontaminated sampling equipment and collecting it in an empty sample container for analysis. Note that it may be necessary for the lab to provide extra, full VOC vials to ensure sufficient volume of blank water to eliminate headspace. Rinseate blanks will be denoted with an “RB” followed by the six-digit date (i.e., RBYYMMDD).

2.9.3 Trip Blanks

The primary purpose of a trip blank is to detect sources of VOC cross-contamination during shipment that might potentially influence VOC concentration values reported in actual samples. Thus, trip blanks serve as a mechanism of control on sample bottle preparation and blank water quality, as well as, sample handling. The trip blank is prepared by the laboratory and travels to the site with the empty sample bottles and back from the site with the collected samples in an effort to simulate sample handling conditions.

Contaminated trip blanks may indicate inadequate bottle cleaning or blank water of questionable quality. The following have been identified as potential sources of contamination:

- Laboratory reagent water;
- Sample containers;

- Cross contamination in shipment;
- Ambient air or contact with analytical instrumentation during preparation and analysis at the laboratory; and
- Laboratory reagents used in analytical procedures.

A trip blank consists of a set of sample bottles filled at the laboratory with analyte-free water. The trip blank and laboratory method blank water must originate from one common source and physical location within the laboratory. Trip blanks will be handled, transported, and analyzed in the same manner as the other analytical samples, except that the sample containers for the trip blanks will not be opened in the field. Trip blanks must return to the lab with the same set of bottles they accompanied to the field.

The trip blanks will be shipped and analyzed at a frequency of one trip blank per cooler per shipment of aqueous samples for VOC analysis. Trip blank sample identification consists of a “TB” followed by the six-digit date (i.e., TBYYMMDD).

2.10 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

Sampling equipment will be decontaminated in the laboratory or the field prior to site use and between sampling locations. The sampling device and equipment decontamination method will involve a non-phosphate detergent wash, tap water rinse, distilled/deionized water rinse, air drying, and a second distilled/deionized water rinse.

Drilling tools will be steam cleaned between each drilling location to prevent cross-contamination. If steam cleaning does not remove coal tar from the drilling tools or other equipment, then a biodegradable degreaser (CitruSolv) will be sprayed onto the drill tools and a scrub brush will be used to help breakdown the coal tar. A tap water rinse will be followed by another round of steam-cleaning. Decontamination will be conducted on the temporary decontamination pad constructed at a location onsite designated by NYSEG. The decontamination fluids will be containerized for proper off-site disposal by NYSEG.

Following well development and prior to sampling, the depth to groundwater in the new and existing wells will be measured using an electronic water level meter or interface probe. To avoid cross-contamination between wells, the water level meter or interface probe will be decontaminated after each use with an Alconox/distilled water wash followed by a distilled water rinse.

2.11 PROJECT FILES

Throughout the field investigation, URS field personnel will maintain field notebooks to document project activities. Each individual making an entry into a field notebook will date and sign their entry. The field notebook entries will contain accurate and inclusive information of the project activities. Only facts and observations will be written in the field notebooks.

In addition, URS field personnel will note all measurements, calculations, and data relating to location, date, time, weather conditions, and sample types directly on the appropriate field records. Copies of field records, which include a soil boring log, a well development record, and a groundwater sampling data sheet, that will be completed in the field are provided in Attachment A.

Photographs may be taken during the field investigative activities. Each photograph will include a scale to show dimensions. All photographs will be labeled to include a description of the feature photographed, the location and depth (if applicable), and date the photograph was taken.

The field notebooks, field records, and photos will be maintained in the project files. The original (final) copies of the field sheets will be maintained by the field personnel and project manager in URS's office in Clifton Park, New York. The project manager will keep copies of all files while the project is active.

Other data files that will be maintained in the project files will include equipment calibration sheets, air monitoring records, analytical requests to subcontract laboratories, survey data, and chains of custody documentation.

Originals of the contract laboratory reports will be stored in the project files and maintained at the contracted laboratory. The laboratory analytical data will be entered into the laboratory's computer database. The data will be manipulated in order to achieve the quality assurance/quality control (QA/QC) and reporting requirements described in the *Quality Assurance Project Plan (QAPP)*. The laboratory will provide URS with a hard copy and electronic copy of the analytical data.

3.0 SAMPLE HANDLING AND CUSTODY

All samples will be collected and handled in a manner such that sample agitation, cross-contamination, and contact with the atmosphere is reduced or kept to minimum. Field personnel will wear new disposable gloves when collecting and handling samples, and will change gloves between sampling locations.

Sample chain of custody will be initiated by the laboratory with the selection and preparation of the sample containers. To reduce the chance for error, the number of personnel assuming custody of the sample and sample containers will be held to a minimum. Personnel involved in the chain of custody and transfer of samples will be briefed on the procedures and their purposes prior to the initiation of sampling.

3.1 FIELD SAMPLE CUSTODY

A Chain of Custody (COC) form will accompany the sample from initial sample container selection and preparation commencing at the laboratory, to the field for sample containment and preservation, through its return to the laboratory.

The Project Manager will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival. Sample shipping containers (coolers or "shuttles") will be provided by the laboratory. The shipping containers will be insulated. All sample bottles within each shipping container will be individually labeled for identification.

The labels will include the following information:

- Site name;
- Sample number;

- Name of collector;
- Date and time of collection;
- Place of collection;
- Type of sample;
- Sample volume;
- Analyses required; and
- Preservative (if used).

If a sample shipping container has been assigned a unique identification number by the laboratory, then this number will be recorded on the COC.

Personnel receiving the sample containers will check each cooler for the integrity of the seals. Coolers or shuttles with broken seals will be returned to the laboratory, and the sample containers will not be used. The receiving personnel will break the seal, inspect the contents for breakage, and record and sign on the COC form that the sample containers have been received. A temporary seal will be affixed to each cooler until the sample containers are filled.

Sample Location Designation

Each soil boring advanced using will be designated by a “SB.”

The proposed well names for the bedrock monitoring wells have been designated by adding “B” to the end of the existing overburden well that the new bedrock well will be paired with.

The surface water sample locations will be denoted with a “SW,” followed by a number. The sediment sample locations will be denoted with a SED followed by a number.

Each surface soil sample location will be designated by an “SS,” followed by a number.

Sample identifications will be designated using NYSEG’s sample identification system.

Sample Designation

Each sample collected will be designated using NYSEG's sample identification system. NYSEG's sample identification system allows a unique code (a combination of up to 12 letters and numbers) to be established for every sample collected, even if samples are collected from different depths at the same location. By following NYSEG's sample identification system, persons familiar with the system can deduce the project location, the sample media, the depth interval of the sample, the year the well was installed or sample was collected, and the sampling location number from the sample name. NYSEG's sample identification system is described below.

Each surface soil sample will be identified by using the following code C_{SS}SX_Y03ZZ where:

C_S = Auburn Clark Street MGP site;

S_S = surface soil sample;

X = starting depth (inches) of sample interval;

Y = ending depth (inches) of sample interval;

03 = year sample collected (2003); and

ZZ = sample location number.

For example, a sample collected from the top two inches (zero to two inches) at surface soil location SS-15 in 2003 would be coded C_{SS}S020315.

For each subsurface soil sample collected from a soil boring location will be identified using the following code C_{SB}BXXYY03ZZ where:

C_S = Auburn Clark Street MGP site;

S_B = soil boring;

XX = the starting depth (feet) of the interval from which the sample was collected;

YY = the end depth (feet) of the interval from which the sample was collected;

03 = year boring installed (2003); and

ZZ = the boring location number.

For example, a subsurface soil sample collected from 8-10 feet from soil boring SB-24 in 2003 would be coded CSSB08100324.

Groundwater samples will be identified by using the following code CSG@##03ZZ where,

CS = Auburn Clark Street MGP site;

G = groundwater sample;

@ = location relative to the "source on the site" which is very subjective, but in general U is for an upgradient well, D is for a downgradient well, and C is for a cross-gradient well;

= the depth of the well. OB is for overburden wells, and BR is for bedrock wells;

03 = year well was installed (2003); and

ZZ = well location number.

For example, groundwater samples to be collected from the proposed well MW-05B in 2003 will be coded CSGDBR0305.

Each surface water sample will be identified using the following code CSSW--03ZZ where:

CS= Auburn Clark Street MGP site;

SW = surface water sample;

-- = always the same in surface water samples because there is no true depth for which the sample is collected;

03 = year sample collected (2003); and

ZZ = the sample location number.

For example, a surface water sample collected from surface water sampling location SW-05 in 2003 would be coded CSSW--0305.

QC samples can be coded using this same system and simply adding a MS or MSD (for matrix spike, or matrix spike duplicate) to the end of the code. Blind duplicates can be coded using this system with a fictitious location number. The locations of each blind duplicate will be recorded in its respective the field sampling sheet.

Once the sample containers are filled, the samples will be immediately preserved, as required and stored at 4 degrees Celsius until delivered to the laboratory. Preservation requirements are provided in Table 1. The samples will be kept cool at 4 degrees Celsius using insulated containers containing sufficient ice or ice packs. If ice is used, the ice will be double-bagged at a minimum. VOC sample jars will be placed in resealable plastic bags prior to placement in coolers. The field sampler will indicate sample designation/location number in the spaces provided on the appropriate COC for each sample of water or soil. The COC will be signed and placed in the cooler. The cooler will be sealed. The samples will be delivered to the laboratory no later than 24 hours after sample collection.

If samples are split and sent to different laboratories, a copy of the COC will accompany the replicate sample. The original COC will accompany the sample for the primary laboratory. The "remarks" column of the COC will be used to record specific considerations associated with sample acquisition such as: sample type, container type, sample preservation methods, and analyses to be performed. The laboratory will maintain on file the completed original forms. Copies will be submitted as a part of the final analytical report.

The specific analyses for each sample are outlined in the workplan. Samples will be collected according to the procedures in this *FSP*. Samples will be hand-delivered or shipped in coolers with sufficient packing material and ice to insure that samples arrive at the laboratory intact, below 4 degrees Celsius, and within 18 hours of shipping.

3.2 LABORATORY SAMPLE CUSTODY

Receipt, storage, and tracking of samples submitted to the laboratory must be conducted according to NYSDEC ASP protocol to prevent sample contamination or loss, as well as, the production of invalid laboratory data as a result of sample deterioration or tampering.

4.0 REFERENCES

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TABLE 1

SAMPLE PRESERVATION REQUIREMENTS

 NYSEG FORMER CLARK STREET MGP SITE
 AUBURN, NEW YORK

TYPE OF ANALYSIS	SAMPLE VOLUME/CONTAINER	PRESERVATION REQUIREMENTS
NON-AQUEOUS SAMPLES		
BTEX (EPA Method 8260)	4 oz. Glass jar, Teflon cap	Cool 4 °C
TCL SVOCs (EPA Method 8270)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
SVOCs (expanded PAHs)(EPA Method 8270 modified)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
TCL PCBs (EPA Method 8082)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
TAL Metals (EPA Method 6010B/7471A/7470A)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
Total Phenols (EPA 9065)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
Cyanide (total & free) (EPA 9012A/4282-02)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
Cyanide (speciation) (Wallschlager)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
Total Organic Carbon (Lloyd Kahn)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
Natural Oxidant Demand	1-6oz. Glass jar, Teflon cap	Cool 4 °C
Reactivity (SW 846 Ch. 7, Sec. 7.3)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
Total Sulfur (ASTM 129.64)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
TCLP Benzene (EPA 1311/8260B)	1-6oz. Glass jar, Teflon cap	Cool 4 °C
AQUEOUS SAMPLES		
TCL VOCs (EPA Method 8260B)	Two (2) 40 ml septa vials, Glass	HCL to pH < 2
TCL SVOCs (EPA Method 8270)	1 Liter Glass	Cool 4 °C
SVOCs (expanded PAHs)(EPA Method 8270 modified)	1 Liter Glass	Cool 4 °C
TCL PCBs (EPA Method 8082)	1 Liter Glass	Cool 4 °C
TAL Metals (EPA Method 6010B/7471A/7470A)	32 oz., Plastic	HNO ₃
Total Phenols (EPA Method 9065)	500 ml, Glass	H ₂ SO ₄ to pH < 2
Cyanide (total & free) (EPA 9012A/4282-02)	8 oz., Plastic	NaOH to pH > 12 0.6g ascorbic acid
Cyanide (speciation) (Wallschlager*)	8 oz., Plastic	NaOH to pH > 13 0.6g ascorbic acid
Alkalinity (EPA 310.1)	4 oz., Glass	Cool 4 °C
Chloride (EPA 9252/325.3)	32 oz., Plastic	Cool 4 °C
TOC, Dissolved (EPA 415.2)	8 oz., Plastic	Cool 4 °C
Nitrate (EPA 300.0)	8 oz., Plastic	H ₂ SO ₄
Nitrite (EPA 300.0)	32 oz., Plastic	Cool 4 °C
Sulfate (EPA 300.0)	32 oz., Plastic	Cool 4 °C
Sulfide (EPA 376.1)	8 oz., Plastic	NaOH / Zinc Acetate
Dissolved Iron (EPA 6010B)	8 oz., Plastic	Cool 4 °C
Total Dissolved Solids (EPA 160.1)	8 oz., Plastic	Cool 4 °C

Notes:

VOCs indicates Volatile Organic Compounds

SVOCs indicates Semivolatile organic compounds

PCBs indicates polychlorinated biphenyls

TAL indicates Target Analyte List Metals

TCLP indicates Toxicity Characteristic Leachate Procedure

* Cyanide by Speciation: Wallschlager, D "Low-Level Speciation of Cyanide in Water", USEPA National Center for Environmental Research and Frontier Geosciences, Inc., Seattle, WA, September 1, 2001.

ATTACHMENT A

FORMS

[illegible]

URS

[illegible]

Trenchnotes

Daily Excavation Report

URS

page 2

EXCAVATION ACTIVITIES

[illegible]

**NYSEG - AUBURN**

WELL NO:

Page 1 of 1

Date: _____

Job No.: _____

Location: NYSEG-Auburn

Total Well Depth (from top of casing):

feet

Depth to Water Surface Before Purging (from top of casing):

- feet

Height of Water Column:

feet

Well Diameter (d): _____ inches

Gals per ft: $(d^2 \times 0.0408) = x$

Volume of Water Column Before Purging:

= gallons or liters

Purging Method:

Bladder Pump/Grundfos Pump/Peristaltic Pump

Meter #[illegible]

Total Volume of Water Purged:

gallons/liters

Sampling Data:

- Sampling Method: Bailer or Pump

- Depth of Pump intake:

feet

- Color: Odor:

Sheen/Appearance:

Notes:

**NYSEG-AUBURN**

WELL NO:

Page ____ of ____

Date: _____

Job No.: _____

Location: NYSEG - Auburn

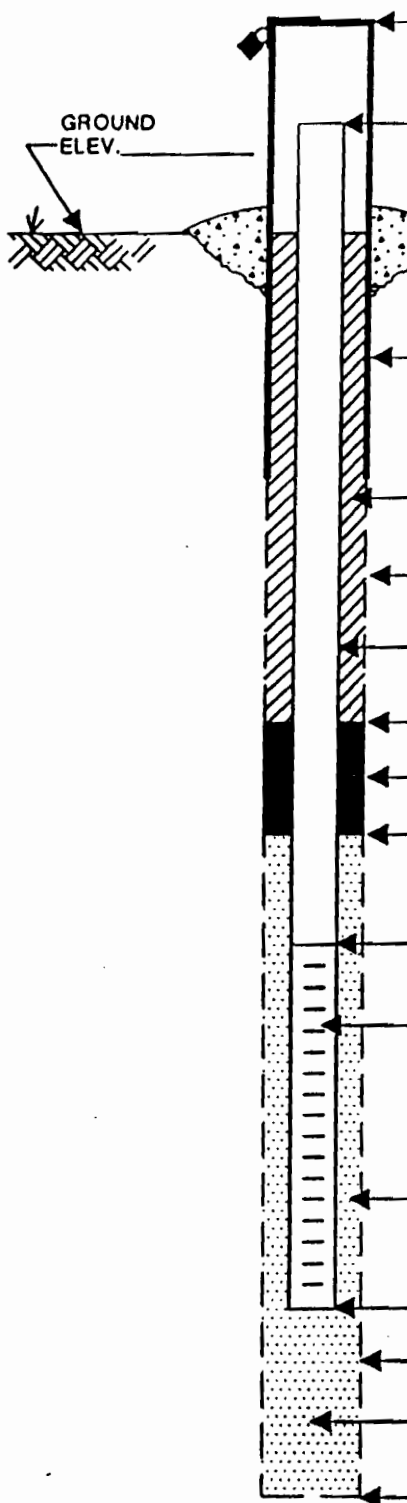
Total Volume of Water Purged: _____ gallons/liters

Notes:

Notes:

Project: _____ Well No. _____
 Project No. and Location: _____
 Installation Date(s): _____
 Field Geologist: _____

Driller: _____
 Drilling Method: _____
 Development _____
 Method: _____



GROUND ELEV. _____

ELEVATION / TOP OF SURFACE CASING : _____

STICK-UP / TOP OF SURFACE CASING : _____

ELEVATION / TOP OF RISER PIPE : _____

STICK-UP / TOP OF RISER PIPE : _____

TYPE OF SURFACE SEAL : _____

I.D. OF SURFACE CASING : _____

TYPE OF SURFACE CASING : _____

TYPE OF BACKFILL : _____

BOREHOLE DIAMETER : _____

I.D. OF RISER PIPE : _____

TYPE OF RISER PIPE : _____

DEPTH OF SEAL : _____

TYPE OF SEAL : _____

DEPTH OF SAND PACK : _____

DEPTH TOP OF SCREEN : _____

TYPE OF SCREEN : _____

SLOT SIZE x LENGTH : _____

I.D. OF SCREEN : _____

TYPE OF SAND PACK : _____

DEPTH BOTTOM OF SCREEN : _____

DEPTH BOTTOM OF SAND PACK : _____

TYPE OF BACKFILL BELOW OBSERVATION WELL : _____

ELEVATION / DEPTH OF HOLE : _____



WELL DEVELOPMENT RECORD

Well No.:

Method(s) of Development:

[illegible]

WATER LEVEL MEASUREMENT SHEET

Measured By: _____

[illegible]

FIELD PARAMETER METER CALIBRATION SHEET

Project# _____

Project Name _____

Meter 1: _____

Equipment # _____

Meter 2: _____

Equipment # _____

Meter 3: _____

Equipment # _____

Meter 4: _____

Equipment # _____

Date	Initials	Meter 1	Meter 2	Meter 3	Meter 4	Comments
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	
		pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	pH SC Temp DO ORP Turb Other	

FIELD PARAMETER METER CALIBRATION SHEET

Instrument _____

Equipment # _____

Project# _____

Project Name _____

Date	Initials	Battery	pH	Conductivity	Dissolved Oxygen	ORP	Turbidity	Comments
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	
			1 2 3 Point List Standards	1 2 3 Point List Standards	Barometer Zero Check (Y/N)	Checked (Y/N) Reading _____ Calibrated (Y/N)	Standard Used:	

ATTACHMENT B
FIELD EQUIPMENT MANUALS

SECTION IV

CALIBRATION

4.1 GENERAL

The Model 580B Organic Vapor Meter is indeed a quantitative instrument and can certainly be used as such. It makes use of the Photoionization Detection System using a lamp with an ionization energy of 10.0 eV which is standard in the Model 580B. Almost all organic materials will be ionized at this energy level. There are some organic materials, such as a few of the freons, methane, ethane and propane that are not ionized and thus will not be detected. The ionization potentials for the various organic materials will simply tell whether the material will be detected by the Photoionization Detector. It does not give any clue as to the sensitivity of the detector for that particular material. Certainly, different organic vapors will have different sensitivities. It is important to understand that the Model 580B does indeed sense most organic vapors and that its response to these different organic vapors will be different.

In this section of the manual, the aspects of calibrating the Model 580B for various vapors will be discussed. In the following section discussing applications, various ways of using the features of the Model 580B will be explained along with the various methods for calibration of the 580B. There will also be applications of the Model 580B in specific instances where the organic vapors or the mixtures of organic vapors are completely unknown. The 580B can be an extremely useful tool, even in areas such as those.

4.2 FACTORY CALIBRATION TEST OF THE MODEL 580B

The Model 580B has been tested for calibration and linearity tested at the factory. The particular gas chosen for this calibration is isobutylene. The Model 580B has good response for isobutylene. Isobutylene standards prepared in air are relatively stable with time, undergoing no serious adsorption or reaction problems. The test information is included in the instrument packet. In addition to the above test a benzene standard is also run. It is important to note that the instrument was not calibrated. It was tested for calibration. Therefore, it should be calibrated by the operator before use.

4.3 METHODS OF GENERATING CONCENTRATIONS OF VARIOUS MATERIALS IN AIR

This section is not intended to be all inclusive as far as the preparation of gas and vapor standards in air are concerned. Only those methods that have been found most practical for the calibration of the 580B are discussed here. There are basically two types of standards, cylinder and bag.

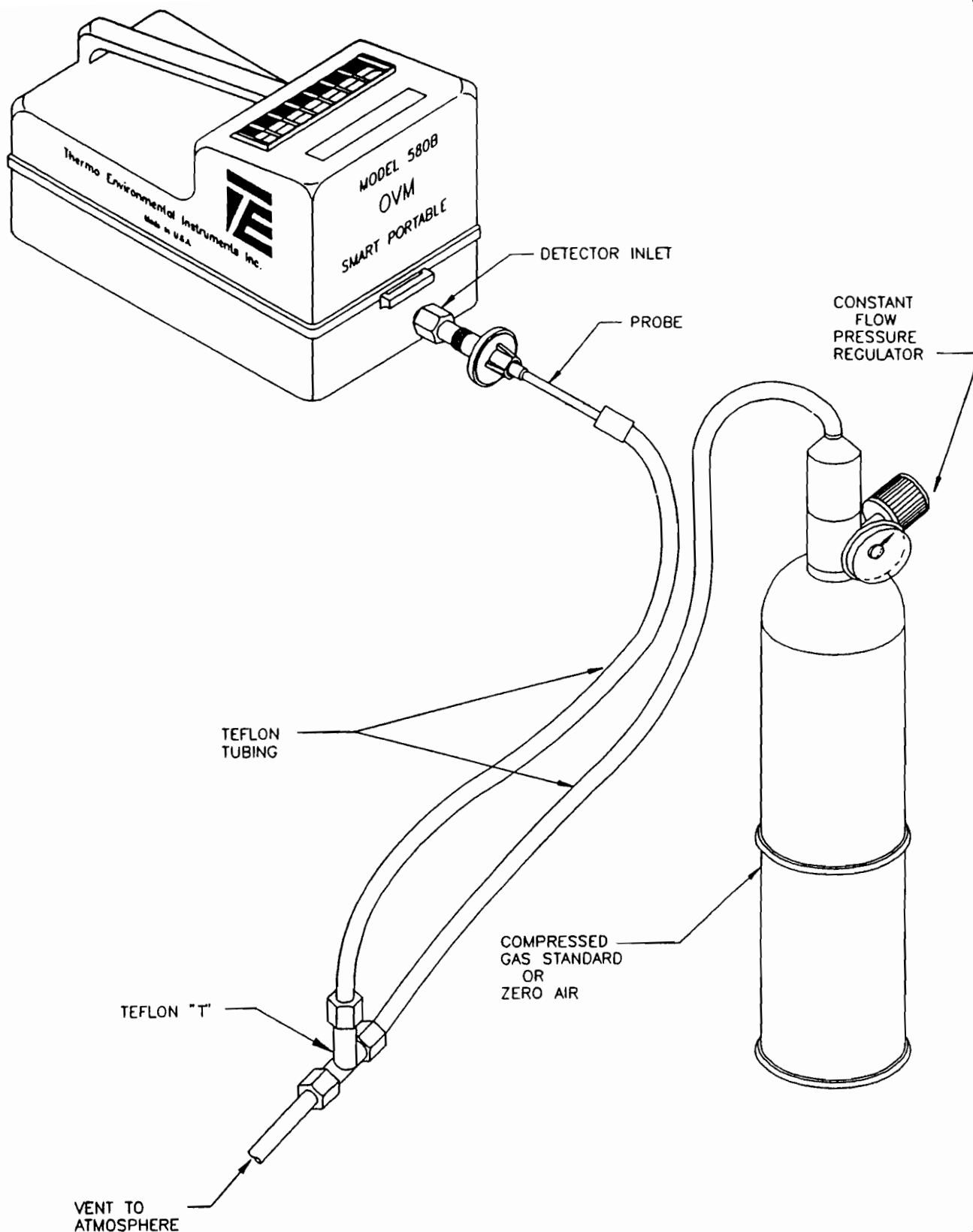


Figure 4.1
Cylinder Calibration

4.3.1 CYLINDER STANDARDS

Certainly commercially available standard cylinders of gaseous materials in air offer the most convenient method of calibration. However, these are static standards. Standards prepared in this fashion in air for vapors of various organic liquids often show concentration reduction with time due to adsorption problems. In general, gases when mixed with air will maintain their concentrations with time since adsorption is generally not a problem.

However, some gases are sufficiently reactive that chemical reaction of the gas will cause a reduction of it in air. These precautions must be observed when using commercially prepared standards for calibration of the Model 580B. It is for this reason that isobutylene in air was chosen as a reference standard for factory calibration. TEI offers a cylinder standard which includes both zero and isobutylene standards. A constant flow pressure regulator sets the flow needed for calibration of the 580B. Figure 4.1 illustrates the physical calibration procedure. The inlet to the 580B is connected to the "T" as shown. It is important that this connection is tangent to the gas flow. The "T" is connected to the regulator on the standard cylinder. It is important that a length of tubing is attached to the "T" location. This prevents diffusion of ambient air into sample line. The regulator and tubing assembly will have to be moved between both the zero air and standard cylinder.

4.3.2 BAG STANDARDS (ISOBUTYLENE)

Bag standards can be prepared in a laboratory and in general are reasonable ways of calibrating the Model 580B. However, it is important that these standards be used shortly after their preparation to reduce the significance of any adsorption problems. Static standards prepared for calibration of the Model 580B are best prepared in collapsible plastic bags. This is opposed to a fixed volume container. The sampling rate of the 580B, which is 500 ml/min, requires an appreciable amount of sample. Even one minute's sampling out of a fixed container will remove 500 ml/min from it. This should not significantly reduce the pressure inside the container. Thus, the collapsible bag provides the best means as opposed to a fixed volume. A 5 gallon polyethylene bag is a convenient size to use for the preparation of static standard.

A tube is inserted into the opened end of the bag and the bag opening then sealed around the tube. The tube should have a cutoff valve or some means of closing the volume of the bag. The volume of air introduced into the bag must be measured. This is most conveniently measured by a wet test meter. However, a source of air flowing through a flow meter can be used if the flow can be held constant, then time is a measure of the volume of the air placed into the bag. All air is expelled from the bag by completely collapsing it prior to connection to the source of air.

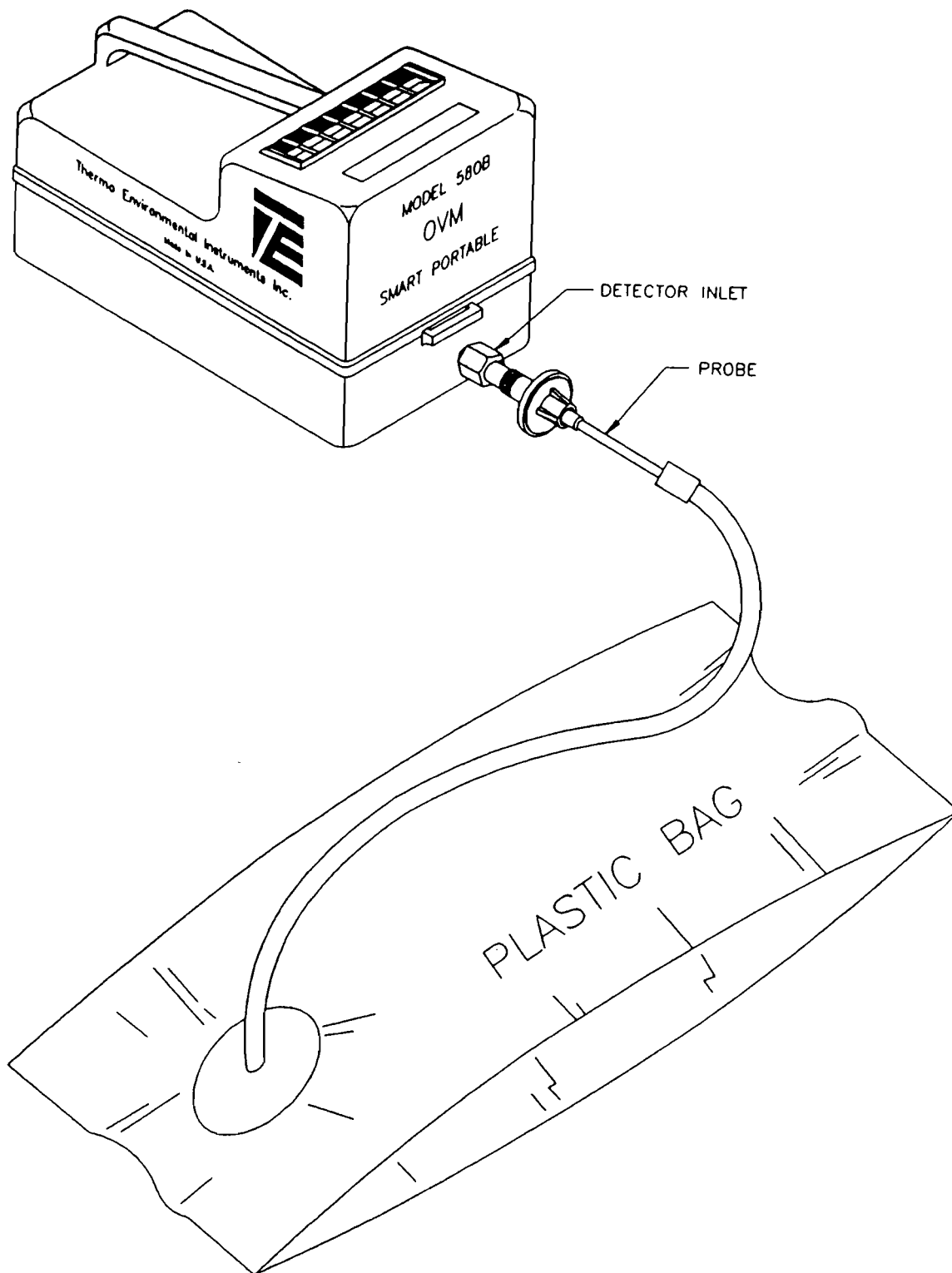


Figure 4.2
Bag Calibration

It can then be connected to a wet test meter or flow meter via a short length of rubber tubing hooked to the plastic tube of the bag. The air flow is started into the bag at a rate of approximately 5L/min. A total of 10 liters is a convenient volume for a 5 gallon bag. This would mean approximately 2 minutes for filling the bag. Figure 4.2 illustrates the physical configuration needed to develop bag standards.

For gaseous samples, the trace organic will be added via a glass hypodermic syringe. The 1 cc Tuberculin syringe is a convenient size. For an isobutylene standard, the 1 cc syringe is flushed with pure isobutylene and then filled to the 1cc mark. While the air is flowing into the plastic bag, the short piece of rubber tubing is pierced by the needle from the 1 cc syringe and the plunger slowly depressed such that the 1 cc of isobutylene is added to the air flowing into the plastic bag. When 10 liters of air have been added to the plastic bag, the flow is immediately stopped and the valve on the tube or the closing clamp is applied to contain the air and isobutylene within the plastic bag. It is best at this stage of the procedure not to rely solely on the diffusion of isobutylene to form a uniform mixture inside the plastic bag. Slight kneading of the plastic bag will hasten the mixing of the isobutylene in air. The plastic tube from the bag is then connected to the probe on the Model 580B via a short length of rubber tubing and the valve on the plastic tube immediately opened. The Model 580B withdraws a sample from the bag at the sampling rate of 500 ml/min. Thus, 10 liters of sample in the bag will provide approximately 20 minutes. Certainly the calibration of the 580B can be accomplished in a shorter period of time. The concentration of isobutylene in ppm by volume will be equal to the sample size, which was 1 cc, divided by the volume of the bag in liters, which would be 10 liters, times 1000. In this particular instance, the concentration would be:

$$\text{Conc (ppm by Vol)} = \frac{1\text{cc Isobutylene} \times 1000}{10 \text{ L Air}} = 100 \text{ ppm}$$

4.3.3 BAG STANDARDS (ORGANICS)

On occasion there is the need to prepare standards other than the normal calibration standard. As mentioned previously, isobutylene was chosen as a standard because of its stability. If other standards are to be used, it is best to develop a relation of the other standard to a standard of known stability like isobutylene. If this procedure is followed, a response factor can be developed by comparing the other organic standard to isobutylene this technique will be discussed in a later section. The following is a suggested technique for preparing other standards.

For organic materials, which are normally liquids at room temperature, the procedure is essentially the same except that an extremely small liquid sample is injected into the flowing air stream rather than the gas sample. This technique works well

It can then be connected to a wet test meter or flow meter via a short length of rubber tubing hooked to the plastic tube of the bag. The air flow is started into the bag at a rate of approximately 5L/min. A total of 10 liters is a convenient volume for a 5 gallon bag. This would mean approximately 2 minutes for filling the bag. Figure 4.2 illustrates the physical configuration needed to develop bag standards.

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$$\text{Conc (ppm by Vol)} = \frac{1\text{cc Isobutylene} \times 1000}{10 \text{ L Air}} = 100 \text{ ppm}$$

4.3.3 BAG STANDARDS (ORGANICS)

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For organic materials, which are normally liquids at room temperature, the procedure is essentially the same except that an extremely small liquid sample is injected into the flowing air stream rather than the gas sample. This technique works well

only for relatively volatile organic materials. The flowing air stream must vaporize all of the material or the calculation will be off. If the material is not rapidly volatile in that flowing air stream, the liquid should be injected through the surface of the plastic bag. Immediately after withdrawing the needle, the hole in the plastic bag should be covered with a piece of plastic tape.

Again, significant kneading of the bag will hasten the evaporation of the sample and mixing of the vapor into the air to provide homogeneous samples. The introduction of this sample into the 580B is the same as before. The calculation of the concentration of the vapor in air is a two-step procedure whereby the small volume of liquid injected into the air stream and into the plastic bag is converted to a volume of vapor. This volume of vapor is then used in the same manner as the volume of gas in the case of isobutylene. The following equations apply:

$$\text{Volume Vapor (uL)} = \frac{\text{Liquid Volume (ul)} \times \text{Liquid Density} \times 24.45}{\text{Molecular Weight}}$$

The above equation gives the vapor volume at atmospheric pressure (760 torr) and 25° C (77F).

$$\text{Then:} \quad \text{Concentration (ppm by Volume)} = \frac{\text{Vapor Volume (ul)} \times 1000}{\text{Air Volume (liters)}}$$

The following is a sample calculation for benzene:

$$\text{Liquid Volume} = 2 \text{ ul}$$

$$\text{Benzene Density} = 0.879 \text{ g/cc}$$

$$\text{Molecular Weight Benzene} = 78.1$$

$$\text{Air Volume} = 10 \text{ Liters}$$

$$\text{Vapor Volume} = \frac{2 \times 0.879 \times 24.45}{78.1} = 0.55 \text{ ul} \quad \text{Benzene Vapor}$$

$$\text{Conc} = \frac{0.55 \times 1000}{10} = 55 \text{ ppm (vol)}$$

The syringe used for the measurement of liquids in this particular instance is a small volume-type such as those manufactured by the Hamilton Company. A convenient size syringe is the 10 micro-liter volume.

4.4 580B CALIBRATION

The following procedure is applicable for both Cylinder and Bag Standards. The sequence requires both Zero gas and Span gas to be used. Span gas can be either contained as a cylinder or bag, in either case the exact concentration used must be known. This concentration will be entered to the 580 when the program provides its entry. With respect to Zero gas, there are several choices. Obviously a certified zero air standard in a cylinder presents no problem. Another choice would be to build a zero air standard in a bag. This can be simply accomplished with the set-up in Figures 4.1 and 4.2 using a charcoal scrubber to remove all the hydrocarbons present in the air. Charcoal does not absorb Methane; this does not cause a problem because the PID does not respond to it. Another approach which could be used in an emergency is to use room air unscrubbed.

This is acceptable if you know that there are no hydrocarbons present or they are exceptionally low in concentration. However, it is not recommended as a standard practice. The physical set up for cylinder calibration is illustrated in Figure 4.1; bag calibration in Figure 4.2.

4.4.1 CALIBRATION ROUTINE

- (A) Set-up calibration assembly with zero air cylinder or bag as described in Figures 4.1 and 4.2.
- (B) Model 580B set-up and zero calibration.
 - 1. Power-up instrument using power plug.
 - 2. Depress ON/OFF Key to ignite lamp and initiate sample pump.
 - 3. Depress MODE/STORE Key.
 - 4. Depress-/CRSR Key in response to LOG THIS VALUE? Prompt.
 - 5. Depress-/CRSR Key to select Parameters Mode from the Main Menu.
 - 6. Depress +/INC Key to advance thru the Run Mode selection parameter prompt.
 - 7. Depress +/INC Key to advance thru the Auto Logging Mode selection parameter prompt.
 - 8. Depress +/INC Key to advance thru the Average Time selection parameter prompt.
 - 9. Depress +/INC Key to advance thru the Alarm Setting parameter prompt.
 - 10. Depress +/INC Key to advance thru Lamp Selection parameter prompt.
 - 11. Depress +/INC Key to advance thru Response Factor Setting parameter prompt.
 - 12. Depress RESET Key to initiate calibration sequence.
 - 13. Depress-/CRSR Key to decline restoration of the backup calibration.
 - 14. Connect outlet of calibration tubing assembly to the Model 580B Detector Inlet as illustrated in Figure 4.2.
 - 15. Introduce Zero Air to Model 580B by opening flow regulator.

16. Depress RESET Key to "Zero" Model 580B.
17. Close Flow Regulator.

(C) Span Calibration - assuming that the Span gas has a concentration of 250 ppm isobutylene the following procedure is followed:

18. Simultaneously Depress RESET and -/CRSR Keys to activate the movable cursor.
19. Repeat Step 18 until the cursor is at the ones place.
20. Simultaneously Depress RESET and +/INC Keys to increment the ones place value.
21. Repeat Step 20 until the ones place value reads 0.
22. Repeat Step 18 to move cursor to the tens place.
23. Repeat Step 20 until the tens place value reads 5.
24. Repeat Step 18 to move the cursor to the hundreds place.
25. Repeat Step 20 until the hundreds place value reads 2.
26. Repeat Step 18 to move the cursor to the thousands place.
27. Repeat Step 20 until the thousands place value reads 0.
28. The LCD should now read:

SPAN PPM = 0250
"+" TO CONTINUE

29. Depress +/INC to accept the span conc. value.
30. Connect isobutylene cylinder (250 ppm) to calibration tubing assembly.
31. Connect outlet of calibration tubing assembly to the Model 580B Detector Inlet.
32. Introduce isobutylene standard to Model 580B by opening flow regulator.
33. Reset key to "CALIBRATE" Model 580B.
34. Close Flow Regulator.
35. Depress +/INC. Key in response to "RESET" TO CALIBRATE message.
36. Depress MODE/STORE to return to the Run Mode.

The instrument has been calibrated and is ready to make measurements.

4.5 DETERMINATION OF RESPONSE FACTORS

As mentioned above, the Model 580 can be calibrated with isobutylene but be set to read correctly, the concentration of another substance. This is done by using the Response Factor that is set in the parameter routine. The default for the response factor is 1.0. The Response Factor is the number that is multiplied by the measured concentration to obtain the correct concentration of the measured component. If the chemical to be measured is less sensitive on a PID than the standard, (usually isobutylene) then the Response Factor is greater than 1.0. If it is more sensitive than the standard then the Response Factor is less than 1.0.

The reason for a Response Factor is practicality. If it is

know that the sample to be measured contains only benzene and therefore the user would like to read benzene concentration directly, there are two approaches. The user could make a bag standard daily of benzene vapor in air and calibrate the 580 directly. Or the Response Factor could be used. In the latter case a bag with benzene is made only once for comparison to a cylinder of a stable standard (such as isobutylene). Then daily, the Model 580 is calibrated with the cylinder standard, a simple operation compared to the work of preparing a bag standard.

As an example, if the bag containing 55 ppm benzene in air as prepared above were measured in a 580 calibrated against isobutylene, the concentration might have been read as 91 ppm. thus the 580 is more sensitive for benzene than for isobutylene.

The Response Factor can now be calculated as:

$$\text{Response Factor (RF)} = \frac{\text{Factor STD Concentration}}{\text{580 Reading of Factor STD}}$$

$$\text{RF} = 55/91 = 0.604$$

When 0.60 is entered into the 580 as the Response Factor, the 580 will read 55 ppm for the bag.

Now the 580 need only be calibrated using an isobutylene standard and a Response Factor of 0.60 to correctly respond to benzene.

Calibration Procedure for the OVM 580B

Turning on OVM 580B

- Insert the power plug into the RUN / CHG port being careful to line up the "bump" on the plug to the slot in the receptacle.
- Press the ON / OFF button until the internal pump starts; then release the button.
- Within 15 seconds the LCD should display the current concentration detected. If the pump shuts down after a few seconds, the lamp was unable to light; press the ON / OFF button until the pump begins again.
- Once the lamp is lit, check the sample pump by covering the inlet tube with a finger to verify vacuum.

Calibration

- Press MODE / STORE button one time. LCD should read "LOG THIS VALUE? MAX PPM = 0000".
- Press -/CRSR button 4 times. LCD should read "RESET TO CALIBRATE".
- Press RESET button one time. LCD should read "RESTORE BACKUP +=YES".
- Press -/CRSR button one time. LCD should read "ZERO GAS RESET WHEN READY".
- Instrument must be placed in a clean environment and then press the RESET button one time. LCD should read "MODEL 580 ZEROING".
- In a few seconds, the instrument LCD will read "SPAN PPM = 0100 "+" TO CONTINUE".
- Press +/-INC button one time. LCD should read "SPAN GAS RESET WHEN READY".
- Attach the calibration gas to the inlet tube, open the gas valve, and then press the RESET button one time. LCD should read "MODEL 580 CALIBRATING".
- After a few seconds the LCD will read "RESET TO CALIBRATE".
- IMPORTANT: Press the MODE / STORE button one time.
- Shut off gas valve and disconnect from instrument. OVM 580B is now ready for operation.

Upon receipt of meter the following operational checks should be performed:

1. Set toggle switch to "on" or turn rotary dial fully clockwise.
2. Submerge the electrode (probe) in tap water. This completes the circuit and activates the buzzer.
3. Depress button to test the battery and circuitry (excluding the probe).

Water Level Measurement

The zero measurement point is:

Model 101 tip of the inner electrode visible near the centre of the probe
Model 102 base of the outer body electrode

- clockwise rotation of rotary dial turns meter on and increases sensitivity.
- always set switch to the highest sensitivity position, then decrease if necessary.

Note: The P4 Probe has been designed to allow substantial submergence. Use of the P1, P2 or P3 probes to sound the bottom of the well may cause water to enter the probe.

Routine Care of the Water Level Meter

1. After the depth of water has been recorded the cable should be carefully rewound onto the reel, the probe wiped dry and replaced into the probe holder.
2. The probe, cable and reel can all be cleaned with soap or detergent and water.
3. Use of a Water Level Meter Carrying Bag adds to the service life of the meter.
4. Use of a Tape Guide adds to the life of the tape.

Care of P4 Probe

Note: Do not remove or twist the strain relief pieces at the back of the probe as this will cause damage to the pressure seal. If the pressure seal integrity is in question, please call Solinst for the authorized repair centre nearest you.

1. While holding firmly onto the black Delrin section on the top of the probe, turn clockwise slightly and pull the P4 sleeve body down.
2. Remove any dirt and water from inside the sleeve body, the centre electrode and the Teflon pieces.
3. Remove and clean the O-rings. Clean the recessed areas and check the O-rings for damage. Lightly lubricate and replace the O-rings.
4. Carefully pull the coil spring from its recessed area and onto the centre electrode. The coils of the coil spring must curve clockwise.
5. Clean the recessed area where the coil spring rests and check to see that the exposed wire is in place and clean.
6. Push the coil spring back into place.
7. Turning clockwise, push the sleeve body over the electrode to the black Delrin piece.
8. To test, turn the unit on and lower the probe into a glass of water. When the probe touches water, the buzzer will sound and the light will come on.

TROUBLESHOOTING

SYMPTOM	CAUSE	REMEDY
No sound when probe immersed in water.	Dead battery.	Replace with 9v Alkaline.
	Water conductivity is very low.	Increase sensitivity switch setting (turn clockwise) or call Solinst for assistance.
	Disconnected wires on circuit board.	Check all connections inside hub of reel for loose/disconnected wires - solder or reconnect.
	Broken wire in tape.	Locate break in tape - splice and seal.
	Disconnected wire inside probe.	Contact Solinst to obtain parts / repair instructions.
Continuous sound after probe is removed from water.	Water conductivity is very high.	Decrease sensitivity switch setting (turn counter-clockwise).
	Damaged components or improper wiring on circuit board.	Contact Solinst to obtain parts / repair instructions.

Battery Replacement

- battery type - alkaline, 9 volt.

1. The battery is housed in the reel hub and is replaced by removing the front plate of the reel.
2. To remove front plate, unscrew three faceplate screws and carefully lift off to the side to avoid damage to wiring.
3. Remove battery and put in new one, making sure the polarity is correct.
4. Replace faceplate of the reel and screws, making sure the wires are fully inside.

Water Level Meter Replacement Parts

The following parts can be provided should they become lost or damaged.

- probes and probe tips
- tapes and cables
- cable reels
- lights, switches, etc.

For further operating information or for repair information,

please call Solinst

(905) 873-2255 or (800) 461-2022

fax: (905) 873-1992



MICROPURGE®
From The Leader in Low Flow Sampling ▼QED



MICROPURGE®
Flow Cell
MODEL **FC4000**

User
Guide

▼QED Environmental Systems, Inc.

The GroundWater Specialists

PO Box 3726 Ann Arbor, Michigan 48106
313-995-2547 800-624-2026 Fax 313-995-1170

E-Mail info@qedenv.com Website <http://www.qedenv.com>

Part Number 95131
Rev #3 2-10-97

pH	pH can be displayed in pH units and as the charge from the pH sensor in millivolts. The mV pH readings are only used for troubleshooting.
Orp	Oxidation/reduction potential is displayed in millivolts.

4.5 Calibration Mode Menu

The *Calibration Mode* menu is used to calibrate the various sensors to known standards so that the data collected is as accurate as possible. The parameters that need to be calibrated on the FC4000 are conductivity, dissolved oxygen and pH. The temperature sensor does not need to be calibrated and is not listed. Calibrating the ORP sensor is listed as an option in the *Calibration Mode* menu but is not required.

It is important to note that errors can occur during calibration. The number that is entered may be out of range, the sensor may be installed incorrectly or the sensor may be drifting. If an error occurs, the meter will reject the calibration and an error message will be displayed on the meter. Some types of errors can be overridden; you will be offered this option if applicable. Two of the most common errors are as follows:

Out of Range

This message indicates that the output of the sensor being calibrated does not conform to the normal range for this parameter. This problem could be due to either a malfunctioning sensor or to a calibration solution which is out of specification. If this error message is encountered, first check to be sure that the pH buffers or conductivity standards have not been contaminated or that the dissolved oxygen sensor is in air for the percent DO calibration or in a solution of known dissolved oxygen concentration for the mg/l DO calibration. Also be certain that the correct value in the correct units has been entered for the calibration solution. If the calibration error message continues to occur, contact QED customer service to determine whether the sensor in question needs to be replaced.

Illegal Entry

This message simply indicates that the keyboard input does not conform to the accepted format for this parameter. For example, the "letter O" may have been entered instead of a zero for a calibration value. Simply return to the desired parameter in the *Calibration Mode* menu and repeat the calibration entry, being certain to enter only numbers.

The specifics of calibrating and caring for each sensor is detailed in sections 4.5 through 4.9. Before beginning the calibration procedures outlined below, it may be helpful to follow some or all of the following calibration tips.

1. Calibration reagents may be hazardous to your health. Use extreme caution when dealing with the reagents.
2. A calibration cup is supplied with the FC4000 system. The calibration cup fits over the outside of the sonde sensor guard. It is therefore not recommended or necessary to calibrate the sonde without the sensor guard in place.
3. Fill a large bucket with ambient temperature water for rinsing the sonde between calibration solutions.

4. Have several clean, absorbent paper towels or cotton cloths available to dry the sonde between rinses and calibration solutions. It is important to remove as much residual liquid as possible from the sonde after each rinse. Shake the sonde to remove excess rinse water from the inside of the guard. Then dry the outside of the sonde and guard. Drying the sonde and probes in this way reduces carry-over contamination of calibrator solutions and increases the accuracy of the calibration, particularly lower conductivity calibration standards.
5. It is not necessary to remove the probe guard to rinse and dry the probes between calibration solutions. The inaccuracy resulting from simply rinsing the probe compartment and drying the outside of the sonde is minimal.

4.6 Temperature Sensor

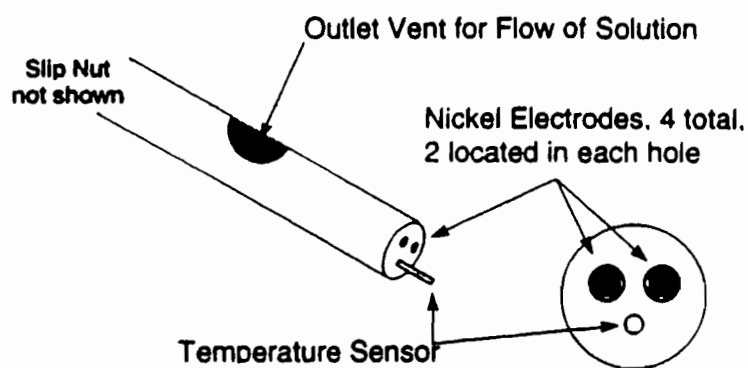


Figure 4.4 Temperature / Conductivity Probe

4.6.1 Calibration Notes

Calibration of the temperature sensor is not required.

4.6.2 Calibration Procedure

Calibration of the temperature sensor is not required.

4.6.3 Care and Maintenance

Maintenance of the temperature sensor is not required.

4.7 Conductivity Sensor

4.7.1 Calibration Notes

When calibrating the conductivity sensor, be sure to take note of the following recommendations:

- When filling the calibration cup prior to performing the calibration procedure, make certain that the level of calibration solution is high enough to cover the entire conductivity cell up to the vent in the side of the cell.
- Be sure to gently agitate the sonde to dislodge any bubbles in the conductivity cell, since the presence of bubbles will affect the measurement.
- Rinse the sensor with deionized water and dry it thoroughly between changes of calibration solutions.
- During calibration, allow the sensor enough time to stabilize with regard to temperature before proceeding with the calibration protocol. Sixty seconds should be enough time. Remember, the readings after the calibration are only as good as the calibration itself.
- Perform sensor calibration at a temperature as close to 25 °C as possible. This will minimize any temperature compensation errors.

4.7.2 Calibration Procedure

Note: This procedure is for calibrating not only specific conductivity, but also conductivity, salinity and total dissolved solids.

1. Place approximately 300 ml of a conductivity standard in a clean, dry calibration cup. The conductivity standard chosen should be within the same conductivity range as the water to be sampled. Standards of 73.9 μS , 718 μS and 6668 μS are available from QED.
2. Insure that the sensor is as dry as possible. Ideally, rinse the conductivity sensor with a small amount of standard that can be discarded. Be certain that you avoid cross contamination of standard solutions with other solutions. Make certain that there are no salt deposits around the oxygen and pH/ORP probes, particularly if you are employing standards of low conductivity.
3. Without removing the sonde guard, *carefully* immerse the probe end of the sonde into the solution. Gently rotate and/or move the sonde up and down to dislodge any air bubbles from the conductivity cell. The probe must be completely immersed past its vent hole.
4. Allow at least one minute for temperature equilibration before proceeding.
5. From the *Calibration Mode* menu, select *Conductivity* and then *SpCond* to access the specific conductivity calibration procedure.
6. Enter the calibration value of the standard being used in mS/cm at 25°C and press *<Enter>*. **Please note that the calibration standard values on the bottles are listed in $\mu\text{S}/\text{cm}$ but must be entered in mS/cm.** The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
7. Observe the readings under Specific Conductivity (SpC), Conductivity (CND) and Temperature (TMP). When they show no significant change for approximately 30 seconds, press *<Y>*.
8. If the calibration has been accepted, press any key to return to the *Calibration Mode* menu.
9. Rinse the sonde in tap water and dry it.

4.7.3 Care and Maintenance

The openings which allow fluid access to the conductivity electrodes must be cleaned regularly. The small brush included in the maintenance kit is ideal for this purpose. Dip the brush in clean water and insert it into each hole 15 to 20 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent with the brush. After cleaning, check the response and accuracy of the conductivity cell with a calibration standard.

4.8 Dissolved Oxygen Sensor

4.8.1 Calibration Notes

- If water-saturated air is used as the calibrating medium, make certain that both the DO reading and the temperature have stabilized for 10 to 15 minutes before starting the calibration sequence. A wet thermistor can indicate artificially low temperature readings due to evaporation which will result in poor temperature compensation and inaccurate readings.
- Insure that the calibration cup being used is vented or pressure released.
- Keep the probe moist when not in use, either by immersing in water or by placing a damp sponge in the calibration vessel. If the membrane appears to be damaged or has dried out, be sure to replace it prior to calibration and deployment.
- Always calibrate the dissolved oxygen sensor at a temperature as close as possible to that of the sample being measured. If possible, immerse the calibration chamber containing either a small amount of water or a wet sponge into the water to be analyzed.
- Before installing a new membrane, make sure that the O-ring groove and the probe tip are clean and smooth. If the KCl electrolyte solution leaks from the probe surface during monitoring studies, the readings are likely to be less accurate in a shorter period of time.

4.8.2 Calibration Procedure

1. Place approximately 1/8" of water or a wet sponge in the bottom of the flow cell.
2. Place the probe end of the sonde into the flow cell. Make certain that the DO and the temperature probes are not immersed in the water.
3. Wait approximately 10 minutes for the air in the calibration cup to become water saturated and for the temperatures of the thermistor and the oxygen probe to equilibrate. Make certain that the calibration cup is vented to the atmosphere.
4. From the *Calibration Mode* menu, select *Dissolved Oxy* and then *DO %* to access the calibration procedure for percent dissolved oxygen. The sequence of screens that will be seen is shown in Figure 4.5.
5. Enter the current barometric pressure in mm of Hg. Remember that barometer readings which appear in meteorological reports are generally corrected to sea level and are not useful for the calibration procedure.

6. Press <Enter> and the current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
7. Observe the readings for percent dissolved oxygen (DO%) and Temperature (TMP). When they show no significant change for approximately 30 seconds, press < Y>.
8. If the calibration has been accepted, press any key to return to the data display and press <Esc> to return to the *Calibration Mode* menu.
9. Rinse the sonde in water and dry it.

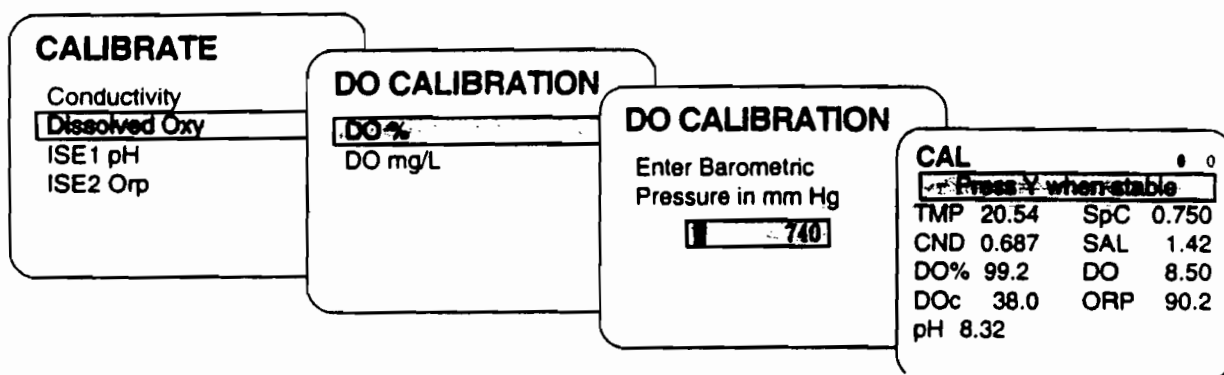


Figure 4.5 DO Calibration Screen Sequence

4.8.3 Care and Maintenance

For best results, it is recommended that the KCl solution and the Teflon[®] membrane at the tip of the DO probe be changed prior to each probe deployment. In addition, the KCl solution and membrane should be changed if:

1. Bubbles are visible under the membrane
2. Significant deposits of dried electrolyte are visible on the membrane or the O-ring;
3. If the probe shows unstable readings or other malfunction.

4.8.3.1 Membrane Replacement Procedure

The following procedure should be followed to change the dissolved oxygen sensor membrane.

1. Remove the FC4000 sensor guard.
2. Remove the used membrane and rinse the sensor with water.
3. After removing the used membrane from the tip of the DO probe, examine the electrodes at the tip of the probe. If either or both of the silver electrodes are black in color, the probe should be resurfaced using the sanding disks which are provided in the p/n 37649 reconditioning kit. Following the instructions supplied with the kit. These directions are also provided below for convenience.
4. Open the membrane kit and prepare electrolyte. To do this dissolve the KCl in the dropper bottle by filling it to the neck with distilled water and shaking until the solid is fully dissolved.

When all of the solid has dissolved, wait 10-15 minutes or until the solution is free of air bubbles.

5. Hold the sensor in a vertical position and apply a few drops of KCl solution to the tip. The fluid should completely fill the small moat around the electrodes and form a meniscus on the tip of the sensor. Be sure no air bubbles are attached to the face of the sensor. If necessary, shake off the electrolyte and start over.
6. Secure a membrane between your left thumb and the probe body. Always handle the membrane with care, touching it at the ends only.
7. With the thumb and forefinger of your right hand, grasp the free end of the membrane. With one continuous motion, gently stretch it up, over, and down the other side of the sensor. The membrane should conform to the face of the sensor.
8. Secure the end of the membrane under the forefinger of your left hand.
9. Roll the O-ring over the end of the probe, being careful not to touch the membrane surface with your fingers. There should be no wrinkles or trapped air bubbles. Small wrinkles may be removed by lightly tugging on the edges of the membrane. If bubbles are present, remove the membrane and return to Step 5.
10. Trim off any excess membrane with a sharp knife or scissors. Make sure the temperature sensor is not covered by excess membrane.
11. Rinse off the excess KCl solution.

Note: Air bubbles under the membrane smaller than 1/16" will not significantly affect the readings and do not require replacing the membrane and electrolyte.

Note: Some users find it more convenient to mount the sensor vertically in a vise with rubber jaws while applying the electrolyte and membrane.

The actual application of the KCl solution and the membrane is represented pictorially in (Figure 4.6) for reference.

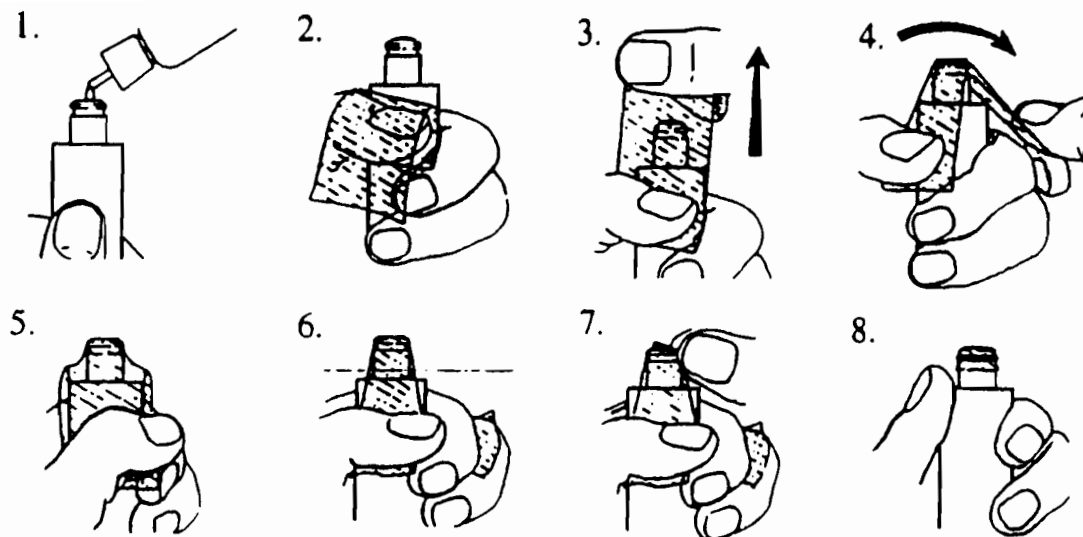


Figure 4.6 DO Membrane Replacement Procedure

4.8.3.2 Electrode Reconditioning Procedure

Note: Be sure to use only the sanding disks provided in the p/n 37649 maintenance kit for the resurfacing operation. Also sand in a direction parallel to the gold electrode. Not adhering to either of these instructions can seriously damage the electrodes.

1. Dry the probe tip completely with lens cleaning tissue.
2. Hold the probe in a vertical position, place one of the sanding disks under your thumb, and stroke the probe face in a direction parallel to the gold electrode. The motion is similar to that used in striking a match. Usually 10-15 strokes of the sanding disk is sufficient to remove black deposits on the silver electrodes, but, in extreme cases, more sanding may be required to regenerate the original silver surface.
3. After the sanding procedure is complete, repeatedly rinse the probe face with clean water and wipe with lens cleaning tissue to remove any grit left by the sanding disk.
4. After cleaning, thoroughly rinse the entire tip of the probe with distilled or deionized water and install a new membrane.

Note: If this procedure is unsuccessful, as indicated by improper probe performance, it may be necessary to return the probe to QED for service.

4.9 pH Sensor

4.9.1 Calibration Notes

- When filling the calibration cup prior to performing the procedure, make certain that the level of the buffer is high enough cover the pH sensor and temperature sensor. Approximately 200 ml in the calibration cup provided will be sufficient.
- Rinse the sensors with deionized water between changes of calibration buffer solutions.
- During the pH calibration, allow the sensors time to stabilize with regard to temperature before proceeding with the calibration protocol. Approximately 60 seconds should be sufficient. The pH readings after calibration are only as good as the calibration itself.
- Clean and store the probe according to the manufacturer's instructions (see section 4.9.3)

4.9.2 Calibration Procedure

1. Place approximately 200 ml of pH 7 buffer in a clean calibration cup, and carefully immerse the probe end of the sonde into the solution.
2. Allow at least 1 minute for temperature equilibration before proceeding.
3. From the *Calibration Mode* menu, select *ISE1 pH* to access the pH calibration options. Select *2 point* by pressing *<Enter>* when it is highlighted and input the pH value of the buffer (7 in this case) at the prompt. Press *<Enter>* and the current values of all enabled sensors will appear on the screen and will change with time as they stabilize in the solution.
4. Observe the readings for *pH* and for Temperature (*TMP*). When they show no significant change for approximately 30 seconds, press *<Y>*.
5. When the display indicates that the calibration is accepted, press any key to continue. The display will show the calibrated reading for the pH 7 buffer.
6. Press *<Enter>* again to continue.
7. Rinse the sonde in water and dry the sonde before proceeding to next step.
8. Place approximately 200 ml of a second pH buffer solution in a clean calibration cup. The second buffer should be pH 4 if the sample is expected to be acidic or pH 10 if the sample is expected to be basic. *Carefully* immerse the probe end of the sonde into the solution.
9. Allow at least 1 minute for temperature equilibration before proceeding.
10. Input the value of the second buffer at the prompt. Press *<Enter>* and the current values of all enabled sensors will appear on the screen and will change with time as they stabilize in the solution.
11. Observe the readings for *pH* and Temperature (*TMP*). When they show no significant change for approximately 30 seconds, press *<Y>*.
12. When the display indicates that the second calibration is accepted, press any key to continue. The display will show the calibrated reading for the second pH buffer.

13. Press <Esc> twice to return to the *Main* menu.

14. Rinse the sonde in water and dry the sonde.

4.9.3 Care and Maintenance

Cleaning is required whenever deposits or contaminants appear on the glass probes. To clean the probe complete the following procedure:

1. Remove the probe from the sonde.
2. Use clean water and a clean cloth to remove all foreign material from the glass probe.
3. Carefully remove any material which may be blocking the circular reference electrode junction of the sensor.
4. Dry the probe port and probe connector with compressed air and apply a very thin coat of O-ring lubricant to all O-rings before re-installation.
5. Reinstall the probe for use or place the probe in the storage container for storage.

For storage up to one week, we recommend leaving the probe in the sonde and storing the sonde in the flow cell containing either a wet sponge or approximately 1/4" of water.

For storage longer than one week, we recommend removing the pH/ORP probe and storing it in a solution of 2M potassium chloride (KCl). The storage bottle in which the pH probe arrived can be used for this purpose. Install a plug in the vacant probe port and place the sonde in the flow through cell containing approximately 1/4" of tap water.

WARNING : Do not store the pH probe in distilled or deionized water.

4.10 ORP Sensor

4.10.1 Calibration Notes

Calibration of the ORP sensor is not required.

4.10.2 Calibration Procedure

Calibration of the ORP sensor is not required.

4.10.3 Care and Maintenance

See Care and Maintenance under the pH sensor section (Section 4.5.3).

ATTACHMENT C
BEDROCK CORING PROCEDURES

BEDROCK CORING PROCEDURES

1.0 ROCK CORE BORINGS

1.0.1 Equipment and Techniques

Diamond drilling is the best means of obtaining samples in most rock materials. It will be used to determine the vertical and lateral extent of contamination in the bedrock aquifers underlying the site and surrounding areas. Ideally diamond drilling results in a continuous sample revealing the characteristics of the entire depth of the hole.

The diamond drilling plant is reasonably versatile and may be adapted for tube sampling in unconsolidated materials, for standard penetration tests, and for permeability tests. The types of drill rigs and variations of drilling equipment used in rock core drilling are very diverse.

1.0.2 Typical Problems in Rock Coring

1.0.2.1 Lost Fluid Circulation

Lost circulation is a very common occurrence in rock coring operations. The depth at which fluid return is lost should always be noted on the logs. It should be determined that the water supply has not been interrupted and that the loss of circulation is, in fact, because of the escape of water into the rock mass surrounding the hole.

It should be remembered that lack of return water indicates that rock cuttings are accumulating either in openings in the rock mass or in the annular space between the drill rods and the inside of the hole. In the former case this may affect the results of any permeability tests carried out in the hole. In the latter case it may make it difficult to retrieve the drill rods or to reach the bottom of the hole following retraction.

1.0.2.2 Non-Self-Supporting Rock Mass

Major drilling problems commonly arise when the rock mass surrounding a drill hole is not self-supporting. Fragments of rock that protrude into the hole above the bit during drilling may retard or prevent extraction. The protruding material may also cause rapid abrasion of the sidewalls of the bit, the core barrel, or the drill rods. Caving that occurs after the rods have been withdrawn prevents the barrel reaching the bottom of the hole for the start of the next run.

In general the steeper and narrower the holes, the less the likelihood of caving. The main techniques for overcoming caving are:

1. Use of high density drilling mud.
2. Drilling casing through the unstable interval and reducing hole size below the casing.
3. Cementing the hole and redrilling after the cement has set.

The choice of technique depends on the nature of the investigation and severity of the problem.

1.0.2.3 Excessive Bit Wear

Because of their composition and texture, many rock types are highly abrasive and cause rapid bit wear. However, it is also very common for excessive bit wear to occur in rocks that are not particularly abrasive. In general, small sized diamonds are used for hard abrasive rock and large diamonds for soft, non-abrasive material. Inherently abrasive rocks in which high bit wear can be anticipated include highly silicic rocks, quartzites, fine-grained granites, cherts, jaspilites and acid volcanic rocks.

Other rocks, such as sandstones and weathered granitic rocks, commonly cause excessive bit wear due to abrasion of the matrix and subsequent removal of diamonds. This kind of bit wear can be avoided if a different bit pattern is used with a closer spacing of diamonds. Bit manufacturers usually provide a service whereby they determine the bit pattern most suited to particular geologic conditions. If problems of this type are anticipated, this advice should be sought prior to commencement of the drilling program.

1.0.2.4 Core Losses

It is very common during diamond drilling that core losses occur (i.e., core recovery is not 100%). Core losses in weak materials are frequently caused by erosion of the core by circulating fluid. These losses are minimized if bottom discharge bits are used and the volume of water is the minimum required to remove the drill cuttings. Vibration of the drill rods also causes disintegration of weak core materials. Vibration may be caused by bent rods or unstable machine mountings.

Core losses in relatively strong materials usually occur when a fragment of rock becomes wedged in some part of the bit or barrel, impeding the further progress of the core into the barrel. This problem usually occurs in highly fractured rock and the point of blockage is commonly the core lifter or core spring.

The driller usually receives notice of a core blockage by a sudden increase in pressure on his water pressure gauge, cessation of downward advance, or a sudden increase in rpm. At this signal he should stop drilling and retrieve the core. Blockages are often temporary and, if drilling continues, the location of the blockage and any associated core loss can be identified by the presence of smooth grind marks on the ends of adjacent pieces of core.

1.0.2.5 Dropped Core

A minor problem common in drilling occurs when part of the core from a run remains in the hole. Dropped core occurs when the core spring is not functioning correctly. Normally, it will not occur if the core springs are replaced regularly whenever they show signs of losing their "spring" and are kept clean and grease-free. Core left in the hole may cause the following problems.

1. If partial core loss has also occurred within the core that was recovered from the hole, it is impossible to determine accurately the depth corresponding to the bottom of the recovered core.

2. Amount of core to be redrilled is not known; therefore, there is a risk of overfilling the barrel on the next run.
3. When the core is redrilled, it tends to be broken up and often rotates to form a blockage in the bit. In these cases, it may require several runs before the bottom of the hole is reached and normal drilling can proceed.

1.0.2.6 Drill Hole Deviation

In deeper drill holes, it is common for the alignment of the boring to deviate from its intended orientation. Deviation of drill holes is especially significant when non-vertical borings are being drilled. In normal foundation explorations and drill holes less than 200 feet deep, deviation usually can be disregarded. However, in mineral exploration or fault investigation, borehole deviations can cause very serious interpretational errors if the deviation is not identified.

Deviation may be caused by a natural wedging process when the drill bit obliquely intersects a resistant layer. It may also occur in foliated rocks due to the different penetrative resistance of alternating laminations, in which case the deviation results in a trend toward the foliation.

A variety of methods are available for the surveying of boreholes to determine the deviations in different parts of the hole. The most common instrument in use is the Tropari compass, which may be used to obtain spot orientations in different parts of the hole.

More sophisticated probes using directional gyroscopes are available. These provide a continuous record of the orientation throughout the hole. This procedure is very expensive and is not economically feasible in most foundation or rock mechanics projects. The same can generally be said for borehole cameras or downhole TV, which are too expensive for general use.

1.0.3 Rock Core Handling and Shipping

The following guidelines should be followed in handling and shipping rock core.

1.0.3.1 Storage

Core should be stored in rigid boxes with securable lids. Suitable materials for box construction are aluminum, stainless steel, wood and reinforced plastic. Cardboard is not suitable except for temporary or emergency storage. Split cardboard half-tubes are available that can be used to line the compartments in a core box and that help prevent highly fractured core from being disturbed in transit.

1.0.3.2 Core Placement

After washing off drilling mud, core pieces are placed in linear sequence in the core box. Core placement starts at the left corner of the hinge side of the core box so that the core can be read in the same manner as a printed page when the reader stands in front of the open box. Cores are arranged as

closely as possible to the original position before measuring. Man-made breaks in the core—whether intentional or unintentional—are marked with parallel lines (marking pen) across the break.

1.0.3.3 Core Marking

Legible and durable characters are marked on the core box or on wood blocks placed at the end of each run to indicate the depth of each core run. Where a segment of core has not been recovered, a wooden spacer is placed with the letters “C.I.” (core loss) and the depth interval at which the core loss occurred. If the location of the core loss is uncertain, the spacer is placed at the bottom of the run.

1.0.3.4 Labeling Boxes

Core boxes are labeled on the top and inside of the lid and on the end faces (edges).

1.0.3.5 Securing Boxes

To prevent accidental spilling of contents, rock core boxes are taped or nailed shut as soon as they have been filled and the core identification has been checked against the boring log.

1.0.3.6 Storage of Boxes

Core boxes are never left where they may be damaged or stolen.

1.0.3.7 Shipment of Boxes

If the boxes are shipped by common carrier, a Sample Shipment Form is completed in triplicate specifying the contents of each box. One copy is packed in the box; another copy is mailed or carried to the project office, and the third copy is retained at the site until completion of the boring program.

1.0.4 **Rock Coring Logs**

The purpose of a rock coring log is to present all the relevant information obtained during drilling and from examination of the cores. The standard URS soil boring logs can be adapted to a rock coring log quite easily. In some cases, more specialized rock coring log sheets may be used on a job. Regardless of the job, the same basic information should be included on all rock coring logs. The following discussion outlines the information to be included on URS log forms that have been adapted for rock coring. If another log form is used, the following information will also be included on that form in an organized and systematic manner.

The identifying information on the first page of each boring log will be filled out completely.

Each succeeding page of the field log should contain at a minimum:

1. Name of field personnel.
2. Job number.
3. Client name.

4. Boring number.
5. Sheet number.
6. Any water level measurement.

The following standard completion note is to be included at the bottom of the last page of each boring log:

BORING COMPLETED AT (depth) FEET ON (date).
CASING USED TO A DEPTH OF (depth) FEET ON (date).
GROUND WATER LEVEL RECORDED AT (depth) FEET ON (date).
HOLE BACKFILLED TO GROUND SURFACE ON (date).

1. The size and depth of casing are to be recorded for both soil and rock.
2. All depth numbers should be recorded in decimals.

The left side of the log must be filled out completely, including the following information.

1. The column headings are reheaded as shown in the sample log in Attachment B.
2. All runs are numbered consecutively for each time the bit is advanced and the sample is removed from the hole. A run with no recovery is numbered.
3. The total length the bit was advanced is recorded.
4. The length of core recovered during the run is recorded. It is usually advantageous to measure the recovery in the core barrel prior to removal. If for some reason this cannot be done, extreme care must be taken in measuring the total length of run since broken and fractured core often appears much longer than its true length.
5. The percent recovery is calculated and recorded for each core run. The percent recovery is computed by dividing the core recovery by the length of the core run, and multiplying by 100. Unrecovered core from one run that is recovered on the succeeding run should be included in the first run for the sake of recovery and Rock Quality Designation (RQD). Such occurrences should be noted on the boring logs.
6. The RQD will be calculated and recorded for each run. The RQD is useful in evaluating rock foundation suitability, grouting programs, rock bolting patterns, or requirements for structural support.

The RQD is calculated by measuring the total length of all sound pieces of core 4 or more inches in length, dividing this total length by the length of the core run, and multiplying the result by 100. Both the total length of all core pieces 4 inches or longer and the percent RQD are recorded on the log.

When considering breaks in the core, the following procedure should be followed:

- a. Mechanical breaks, whether intentional or unintentional, are overlooked and treated as sound rock.
- b. Pieces of core 4 or more inches in length with a vertical fracture or joint are counted as sound rock in the modified core recovery.
- c. Angle fractures are measured to the center of the angle.

Qualitative terms have been developed to describe rock quality as computed by the RQD and are listed in Table 4-1.

Table 4-1
Rock Quality Terms

Percent RQD	Descriptive Rock Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

7. On many jobs, it is helpful to record the penetration rate in minutes per foot. The penetration rate is useful in comparing relative "drillability". The penetration rate is affected by rock hardness; density, drilling rpm, pull-down pressure, circulating water pressure, and drill bit wear and design. Thus it is important to note all changes in drilling procedure on the log.
8. On some jobs, it is advantageous to calculate the fractures per foot and record it on the logs. The core is divided into intervals based on the predominant frequency of fracture spacing. The fractures in each interval are counted and the total number is divided by the length of the interval. The limits of each interval are not made to correspond to a particular footage or to the ends of each run. Preferably a distinction is made between natural fractures and fractures due to drilling and handling (mechanical fractures). Where this is possible, only the natural fractures are included on the log. In some cases, such as deep holes in fresh rock, where it is not possible to distinguish natural fractures, all fractures are included. The method that is adopted should be specified on the log.
9. The run interval and run number should be displayed graphically in the "depth in feet" column. The depth of the hole should be determined after each run. Field personnel should constantly be aware of the depth and should check the depth measurements made by the driller.

The right side of the boring log should contain a detailed description of the rock units and all pertinent information regarding drilling operations. The following information should be included.

1. The system of rock classification will be determined by the Project Manager or Principal Investigator before field operations commence. There are many good, similar systems of rock classification in print; however, it is recommended that the following reference be used: Travis R. B., 1955, Classification of Rocks: Quarterly of the Colorado School of Mines, V. 50, no. 1, p. 98.
2. Rock descriptions should be listed in the following order:
 - a. Lithology
 - b. Color as determined by GSA Rock Color Chart or Munsell Soil Color Charts.
 - c. Grain size or crystallinity.
 - d. Bedding.
 - e. Other observations such as vug percentage, mineralization, fossil content, or weathering.
3. The degree of weathering of the core is estimated according to Table 4-2. This classification is applicable to rock materials that are relatively strong in the unweathered state. For materials such as shale, which are weak in the unweathered state, it is often difficult to assess the degree of weathering. In these cases a simplified classification using only the terms "fresh," "partly weathered", and "extremely weathered", is used. Where "fresh" and "extremely weathered" have the same definitions as that below in Table 4-2, "partly weathered" is used for anything intermediate.

Table 4-2

Term	Description
Fresh	The rock shows no discoloration loss of strength or any other offset weathering.
Slightly Weathered	The rock is slightly discolored, but not noticeably lower in strength than the fresh rock.
Moderately Weathered	The rock is discolored and noticeably weakened, but 2-inch diameter drill cores cannot usually be broken up by hand, across the rock fabric.
Highly Weathered	The rock is usually discolored and weakened to such an extent that 2-inch Diameter cores can be broken up readily by hand, across the rock fabric. Wet strength usually much lower than dry strength.
Extremely Weathered	The rock is discolored and is entirely changed to a soil, but the original fabric of the rock is mostly preserved. The properties of the soil depend upon the composition and structure of the parent rock.

4. Bedding characteristics are defined as displayed in Table 4-3.

Table 4-3

Average Bed Thickness	Term
<0.001 foot	Thinly laminated
0.001 to 0.01 foot	Laminated
0.01 to 0.1 foot	Thin Bedded
0.1 to 1.0 foot	Medium Bedded
>1.0 foot	Thick Bedded

5. Quantification of descriptive terms is highly desirable. For instance “some small vugs” would better be described as “10% to 15% vugs, average size 0.1 cm ranging up to 0.5 cm”.
6. Because rock defects severely modify the characteristics of the rock mass, the description of rock defects is a very important aspect of the coring log. Common defects requiring description are solution cavities, lava tubes, soil seams, shear zones, joints, and localized (joint, shear zone, and so forth) is being described, its orientation relative to a plane perpendicular to the axis of the core is included. The condition of fracture or joint surfaces also is described (open, calcite-lined, closed, and so forth). If planar defects are filled with material of different composition than the parent rock, the type of filling material is described (calcite, kaolinite, sandy clay, chlorite, and so forth).
7. It is useful to construct a vertical line on the right side of the boring log to separate the rock description from the comments on drilling operation. The comments should include procedural drilling operations and any observations that might relate to the geologic, hydrologic or engineering characteristics of the rock mass. Typical items to be included are:
- Sequence of casing operations, including casing diameter and depth.
 - Depth at which noticeable changes in the operation of the drill occur. Includes sudden changes in pitch, rpm, vibration, pump pressure, or rate of penetration.
 - Bit drops or suspected voids.
 - Gain, loss, color change, or change in consistency of the circulating fluid.
 - Evidence of mineralization or oil and gas.
 - Amount of cement used and depth interval of the setup cement if a hole has to be stabilized by cementing.
 - Explanations for the probable cause of core losses.

APPENDIX D
GEOLOGIC CROSS-SECTIONS

NEW YORK STATE
ELECTRIC & GAS
CORPORATION

CLARK STREET MGP SITE
AUBURN, NEW YORK

HORIZONTAL SCALE: 1" = 30'

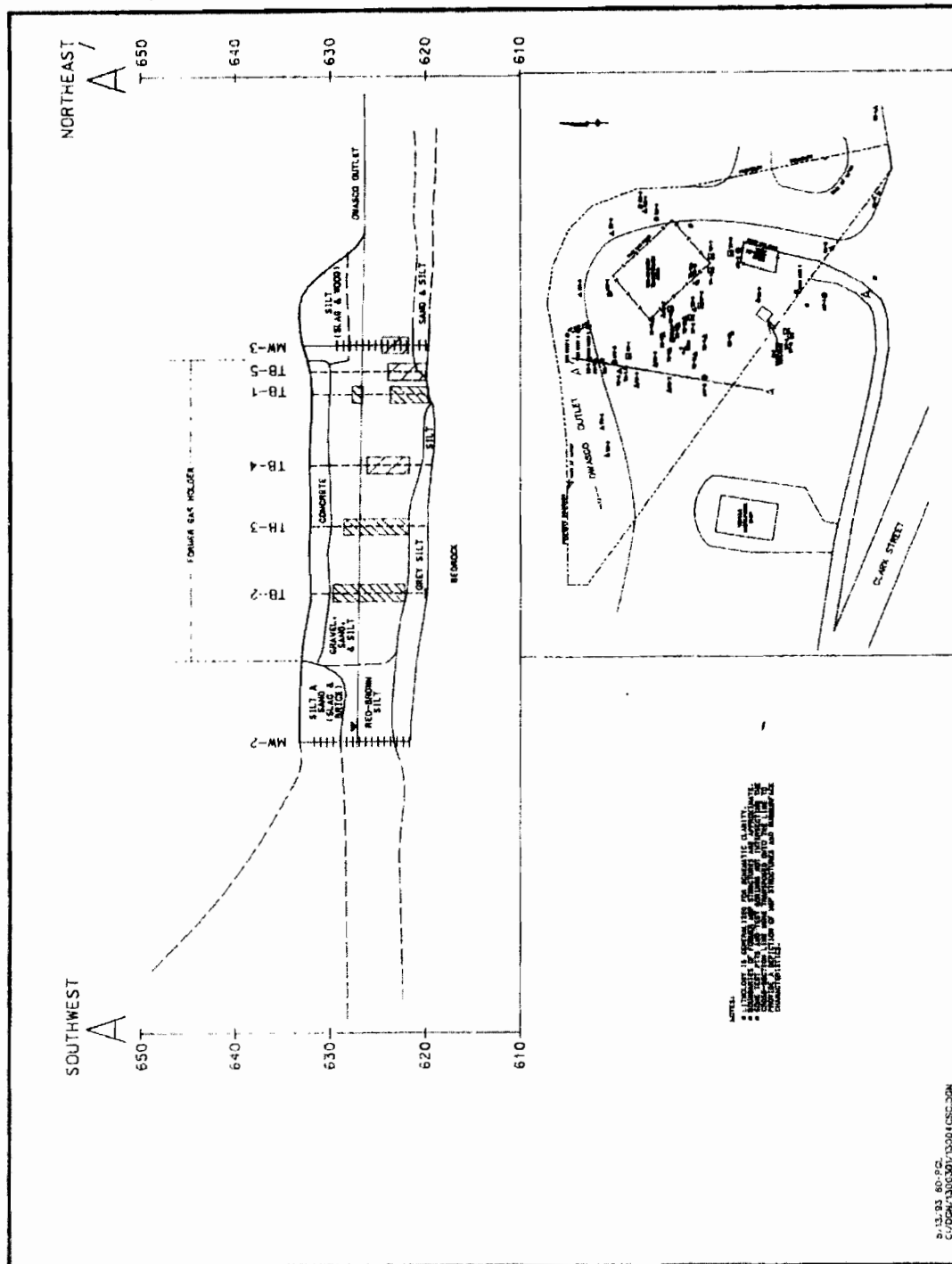
0 15' 30' 45'

100-443887-100

**GEOLOGIC
CROSS-SECTION
A-A'**



WILKINS & DICK ENGINEERS, P.C.
CONSULTING & CONTRACTING



013.93 60.90
C/DGM/1300301/1300 CSC.DON

12/10/92

WEL - 10.

WATER LEVEL

SCREENED INTERVAL

BLACK STAINING

OIL CLOUBLES

TAP RESIDUE

THICK TAR

NEW YORK STATE
ELECTRIC & GAS
CORPORATION

CLARK STREET WGP SITE
AUBURN, NEW YORK

HORIZONTAL SCALE: 1" = 30'
0 15' 30' 45'

VERTICAL SCALE: 1" = 10'

**GEOLOGIC
CROSS-SECTION
B-B'**



BLAIR'S & SONS STATIONERY - P.C.
 1000 W. 10th St. - Seattle, Wash. 98104

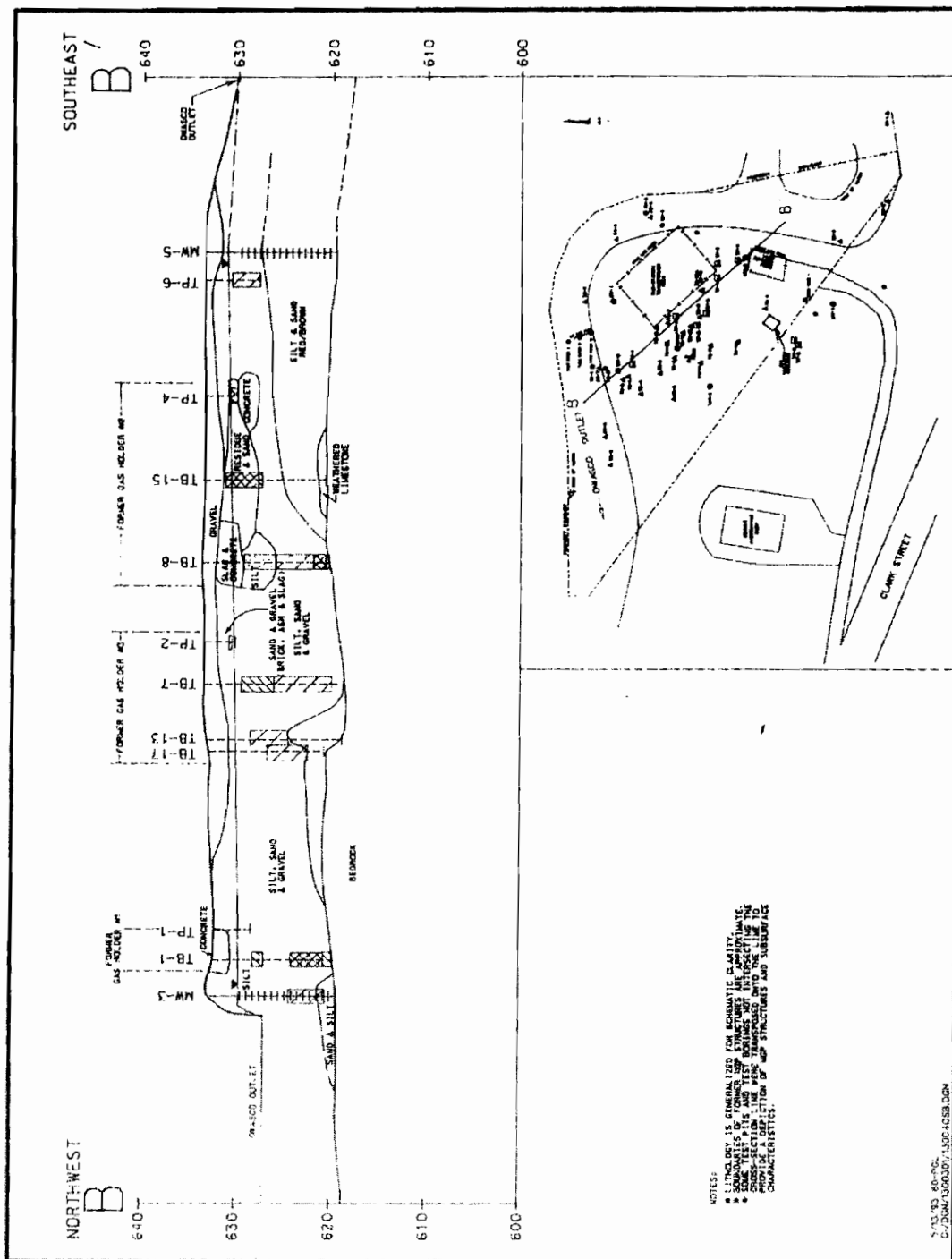
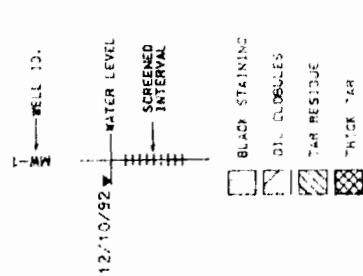


FIGURE 8



NEW YORK STATE
ELECTRIC & GAS
CORPORATION

CLARK STREET MGP SITE
ALBURN, NEW YORK

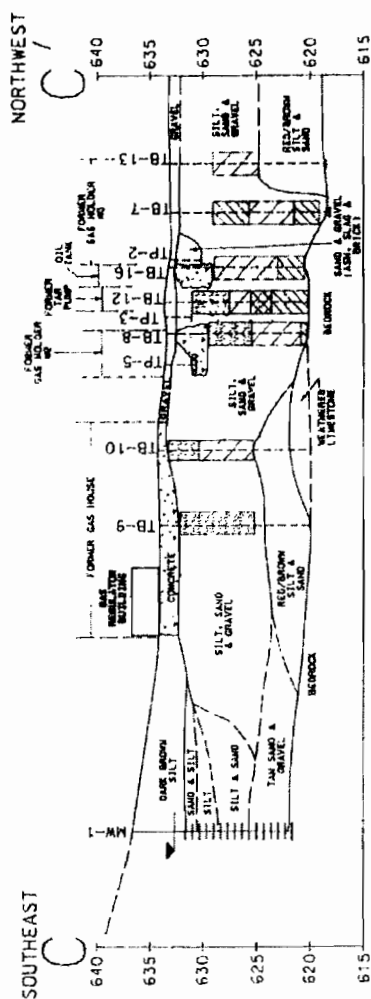
HORIZONTAL SCALE: 1" = 20'

VERTICAL SCALE: 1" = 10'

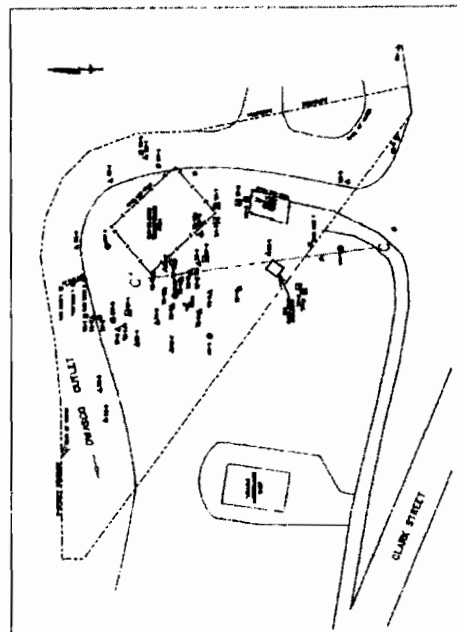
**GEOLOGIC
CROSS-SECTION
C-C'**



ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED
DATE 08-11-2010 BY 60322
UCBAW/BJA



- LITHOGRAPH IS GENERALIZED FOR SOCRATIC CLARITY.
- SIMILARITIES BETWEEN THE TWO ARE NOTED IN THE CROSS-SECTION. THE WERE TRANSPORTED INTO THE LINE TO PROVIDE A DEPICTION OF MSP STRUCTURES AND SURFACE CHARACTERISTICS.



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