NYSEG

NEW YORK STATE ELECTRIC & GAS

SUPPLEMENTAL REMEDIAL INVESTIGATION WORKPLAN GENEVA-BORDER CITY FORMER MANUFACTURED GAS PLANT GENEVA, NEW YORK

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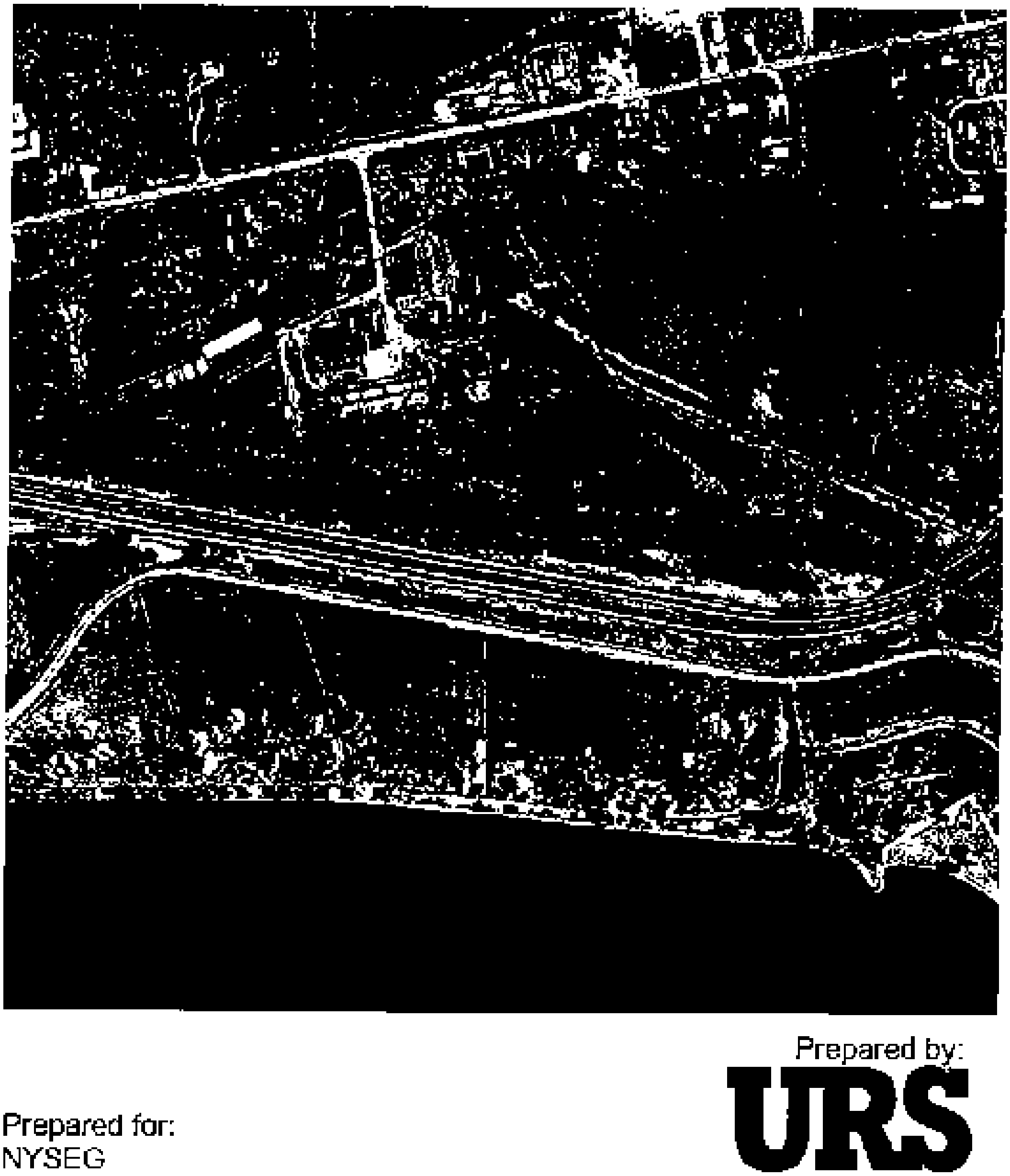

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1.0 INTRODUCTION

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 Geneva-Border City Former Manufactured Gas Plant (MGP) site in Border City, Seneca County, New York. The location of the former MGP facility is shown in Figure 1. The NYSDEC's identification number for the site is 8-50-008.

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, Field Sampling Plan,* and *Health and Safety Plan*) will be submitted to NYSDEC for review after NYSDEC and NYSEG agree on the *SRI* scope of work as presented in detail in this document. Outlines for the *QAPP* and *HSP* are in Appendix A & B, respectively. The *Field Sampling Plan (FSP)* is included with this document in Appendix C.

The technical approach and scope is based on the investigative results collected by Woodward-Clyde Consultants (WCC), TRC Environmental Consultants, Inc. (TRC), and Blasland & Bouck Engineers (BBE). These previous investigations are summarized in these eleven documents:

- Woodward-Clyde Consultants, *Letter to Mr. James B. Marean, NYSEG*, dated May 18, 1984.
- Woodward-Clyde Consultants, *Letter to Mr. James B. Marean, NYSEG*, dated August 18, 1984.
- Woodward-Clyde Consultants, *Letter to Mr. James B. Marean, NYSEG,* dated November 6, 1984.
- TRC Environmental Consultants, Inc., *New York Electric and Gas Corporation, Investigation of the Former Coal Gasification Site, Geneva, New York, Task 1 Report, Preliminary Site Evaluation,* dated May 14, 1986.

- TRC Environmental Consultants, Inc., *Task 2 Report, New York Electric and Gas Corporation, Investigation of the Former Coal Gasification Site, Geneva, New York, Task 1 Report, Preliminary Site Evaluation,* dated October 1, 1987.
- TRC Environmental Consultants, Inc., *Final Task 3 Report, Investigation of the Former Coal Gasification Site, Geneva, New York,* dated September 30, 1987.
- TRC Environmental Consultants, Inc., *New York Electric and Gas Corporation, Summary of Indoor Air Quality Investigations and Exposure Assessment, The Former Coal Gasification Site at Geneva, New York,* dated August 16, 1988.
- TRC Environmental Consultants, Inc., *Task 4 Report, New York Electric and Gas Corporation, Investigation of the Former Coal Gasification Site, Geneva, New York, Technical Report*, dated April 4, 1989.
- Blasland & Bouck Engineers, P.C., Letter to Mr. Tracy L. Blazicek, NYSEG, dated April 28, 1993.
- NYSEG, *Letter to Mr. Jeffrey A. Edwards, NYSDEC, Draft Scope of Work for a Supplemental Remedial Investigation, Geneva Border City MGP Site*, dated April 20, 2001
- NYSDEC, *Letter to Mr. Tracy Blazicek*, dated June 26, 2001

1.1 PROJECT OVERVIEW

From approximately 1901 through 1934, NYSEG (or its predecessor companies) used the former MGP site in Border City to manufacture gas from coal. The portion of the site that contained the historic MGP operations and the associated structures are shown in Figure 2.

Previous investigations of the site include an investigation conducted by WCC in 1984, a series of investigations conducted by TRC in the late 1980's, and an investigation conducted by BBE in 1993. 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 Geneva-Border City 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 that is focused on documenting the nature and extent of MGP-related residuals in sufficient detail to complete a *Feasibility Study*.

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;
- Evaluate the distribution of MGP-related contaminants in the soils, groundwater, sediment, and surface water based on the available data;
- Characterize groundwater quality in the overburden and bedrock regimes based on the available data;
- Evaluate the distribution of contaminants in the off-site environs based on the available data;
- Identify data gaps needed to evaluate the nature and extent of site contaminants; and
- Present a scope of work to collect data from those data gaps.

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 located in Border City, Seneca County, in the Finger Lake Region of New York State near the north end of Seneca Lake (Figure 1), two miles east of the City of Geneva. The site is approximately 1,500 feet north of the north shore of Seneca Lake. Between the site and Seneca Lake is Seneca Lake State Park and New York State Route 5 and US Route 20. The locations of the present site buildings and the former structures are shown on Figure 2. Currently there are approximately eight buildings onsite, several of which were previously used in the gas manufacturing process while the facility was in operation. The majority of the site is paved, with the exception of the western property extension.

There is an electric substation, which is currently in use, at the north end of the facility. There is a liquefied natural gas vehicle refueling area on the west side of the entrance road. The western end of the facility is an open storage area, which has been graded flat and is used to store pipes and poles along with other large pieces of equipment. A former settling basin is located south of the site and was historically used for the treatment of sanitary wastes from the facility through an oxidation process.

There are two unnamed streams on-site. These streams are shown on Figure 1. The eastern stream originates in the wetlands in the northern part of the site. The second stream is in the southwestern part of the site. Both streams cross Seneca Lake State Park located to the south of Routes 5 and 20 and flow into Seneca Lake.

2.2 SITE HISTORY

The Empire Coke Company constructed the original MGP plant at the site between 1901 and 1903. The original plant consisted of 31 coke ovens and two gas holders. The plant produced gas as a by-product of the coking operation. In 1909, the facility was expanded to allow the production of blue gas. The 1909 expansion included a 100,000 cubic foot holder associated with the Blue Gas operation and fourteen additional coke ovens, bringing the total number of ovens to 46. In 1914, the plant was sold to Empire Gas and Electric Company. In 1925, New York Central Electric Corporation purchased Empire Gas and Electric Company. NYSEG has owned the property since 1932.

Historical plant operations were described in TRC's *Task 1 Report*, dated May 14, 1986. Coal was brought to the site by rail. Gas was produced by heating the coal in the onsite coke ovens. The hot coke was pushed out the back of the ovens and quenched with water. The gas was collected from the top of the ovens and the liquid and gas components were separated. Tars were separated and stored in tanks pending their disposal. The gas was purified in the purifying building using wood chips impregnated with iron oxide to remove particulates. The purified gas was stored in the gas holders prior to distribution.

On August 29, 1934, the gas plant was officially closed. After the gas plant closed, some of the gas making structures were razed and the remaining ones were converted for use as NYSEG's operations center for the Geneva area. The coke ovens were used for dry storage until they were demolished and disposed offsite as scrap in 1936. Most of the remaining steel at the site was removed as scrap during World War II.

Currently, the site is a NYSEG Service Center and gas and utility substation. Maintenance and utility trucks are stored onsite and there is an office building used for accounting and customer service. Large utility poles, transformers, gas pipes and various utility scrap materials (old transformers and pylons) are also stored at the site.

2.3 PHYSICAL SETTING

The site is generally flat lying and is at an elevation of approximately 460 feet above mean sea level (NGVD29). There are a few exceptions to this where the foundations of the former coking ovens remain in place and rise above the surrounding surface by approximately six feet. Off-site the topography drops to the east, west, and south into a low lying wetland area and to the shores of Seneca Lake.

The regional surface water hydrology is dominated by Seneca Lake, which is approximately 1,500 feet south of the site. There are two unnamed streams on-site, which flow through the Seneca Lake State Park that is south of the site beyond Routes 5 and 20. The streams discharge into Seneca Lake through culverts in a retaining wall. The surrounding area is poorly drained with numerous marshes and wetlands and small ponds.

Surface runoff at the site generally flows to the eastern stream, which originates in the wetlands in the northern part of the site.

Geology

The site is near the boundary of the Central Lowland and the Alleghany Plateau physiographic provinces. The Central Lowland physiographic province is generally characterized as a poorly drained and fairly level plain, whereas there are rolling hills and uplands separated by streams and lake valleys within the Alleghany Plateau.

The geomorphology of the region has been shaped by glacial processes. Continental ice sheets smoothed the upland and scoured the valleys in the Geneva area. The glacial deposits in the area are dominated by alternating layers of lacustrine clay and silt and deltaic sand and gravel.

Site specific bedrock geology is based on the log of an injection well drilled south of the service building at the site in 1927 and a 1985 seismic refraction survey. The injection well is reported to be 336 feet deep with an open-hole interval that intercepts the Onondaga Limestone (Mozola, 1951). Onondaga Limestone consists of Devonian age limestones and shales. The top of bedrock is approximately 175 feet bgs in the eastern portion of the site and is slightly deeper, approximately 200 feet bgs, in the western portion of the site. According to the seismic refraction survey, and the boring log of the former injection well, there were no indications of glacial till overlying the bedrock.

Fill consisting of soil, brick fragments, gravel and concrete was encountered to depths of 13.5 feet bgs during previous investigations. MGP residues observed in the fill included purifier wastes, tar, coke and coal fragments, coal slag, and demolition debris.

Underlying the fill are layers of clay-rich silt, silty sand, and lacustrine clay layers. These silty sand and clay layers are approximately 75 feet thick and are underlain by ten to 20 feet of soft interbedded gray and red clay. A fine to medium sand unit underlies the clay.

Hydrogeology

There are two important aquifer systems in the Geneva area. The glacial unconsolidated deposits in the valleys serve as an aquifer. The Onondaga Limestone and the Camillus Shale are also commonly used bedrock aquifers.

Reportedly, there are several pumping wells within one mile of the site. The uses of the wells include: industrial, commercial, domestic, and agricultural water supply. Well yields are reported to be up to 200 gallons per minute (gpm) from the Onondaga Limestone and up to 1,000 gpm from the Camillus Shale (Mazola, 1951).

Overburden Groundwater System

Previous investigations conducted by TRC have shown that groundwater in the shallow and deep overburden deposits flows from the northwest to the southeast. This groundwater flow direction is expected since there are wetlands located to the southeast of the site, which would act as local discharge areas, and Seneca Lake is located to the south, which is considered the regional groundwater discharge point. Downward vertical gradients were reported for the overburden deposits across the site, with the exception of the monitoring well clusters located in the area of the eastern wetlands that show upward vertical gradients. This upward vertical gradient supports the assumption that the wetlands to the east are local discharge areas for the groundwater leaving the site.

Bedrock Groundwater System

Very little is known about the bedrock groundwater regime at the site, since no bedrock monitoring wells have been installed to date onsite. Based on regional groundwater data, the groundwater flow in the area of the site is expected to be to the south, towards Seneca Lake, which is a local and regional discharge point for the bedrock groundwater system. However, the groundwater flow within the bedrock may be partially controlled by the local extraction of groundwater.

Groundwater flow within the bedrock is expected to be through secondary porosity features, such as fractures and solution cavities. As indicated by production well logs in the area, the bedrock wells are capable of producing several hundred gallons per minute.

2.4 PREVIOUS INVESTIGATIONS

This section briefly summarizes the previous investigations completed at the site. From 1984 through 1993, NYSEG conducted five investigative phases including a risk assessment. The scope of work completed during these five activities is described below and is followed by a summary of the findings of the previous activities. Figures 3 through 6 summarize the available analytical results from these previous investigations.

1984 Soil Boring Investigation

In 1984, Woodward-Clyde Consultants (WCC) conducted an investigation to evaluate the subsurface conditions at the site for a new service garage location and a new sanitary sewer line connection to a new city sanitary sewer line near the central portion of the site. A total of 21 shallow soil borings (B-1 through B-21) were advanced at the site. These 21 soil borings were advanced to total depths ranging from 2.5 to 10.5 feet below ground surface (bgs).

The borings logs indicate that odors were encountered at five of the 21 borings at depths between three to five feet bgs. Liquid coal tar was observed to be seeping into two borings (B-9 and B-10) that were advanced on the planned sewer line and near a former underground storage tank (UST) that had been used for tar storage during MGP operations. According to WCC, this UST had been closed-in-place. According to WCC, an open chamber was encountered in boring B-1 and was thought to be a remnant of the coke oven facility.

A total of 12 soil samples and one water sample were collected and analyzed. Laboratory analyses included total phenolics, limited list of purgeable aromatic volatile organic compounds (VOCs) using Method 602, and limited list of base/neutral semivolatile organic compounds (SVOCs) [polynuclear aromatic compounds (PAHs) only] using Method 610.

Preliminary Site Evaluation (1986)

In 1986, a Preliminary Site Evaluation was conducted by TRC Environmental Consultants, Inc. (TRC) to develop an understanding of the site's history, site ownership and operating procedures, and information on the regional and site geology and hydrogeology. This study was the first of four tasks performed by TRC. In addition, two phases of geophysical work and an air quality survey of the existing buildings were conducted. The objective of the initial phase of the geophysical investigation, which included a seismic refraction survey, was to evaluate whether there was a glacial till layer beneath the site and to evaluate the depth and nature of the bedrock surface. The objective of the second phase of geophysical work, which consisted of an electromagnetic (EM) survey, was to further evaluate and delineate potential areas of contamination identified during the initial survey work.

The seismic survey showed that bedrock is at approximately 175 feet bgs near the eastern boundary of the site and 200 feet bgs near the western edge of the property. The survey indicated that the bedrock is massive, unweathered, and unfractured and that the overlying materials are saturated alluvial deposits. There was no indication of glacial till. The EM survey suggested extensive (elongated east-west area) near-surface soil contamination along the southern property boundary.

Based on the findings of the historic records review in TRC's Task 1 Report, the following by-products were generated at the site:

- Iron-oxide purifier wastes;
- Tars;
- Water used to quench hot coke;
- Water discharging from the cooling coils and turbines; and
- Wastewater from drip boxes located underneath equipment or gas lines to collect condensation.

The coke plant produced both solid and liquid wastes that were disposed onsite. Most of the solid wastes were transported by hand or by wheelbarrow to the disposal area that was located in the eastern portion of the property. According to a former employee, topsoil was placed over the disposal area in the eastern waste area and the surface was regraded on a yearly basis. The eastern waste area is shown in Figure 2.

The materials that were disposed of in the eastern waste area included iron-oxide purifier wastes, tars, ammonia concentrate, and miscellaneous solid wastes. Iron-oxide purifier wastes were disposed onsite roughly twice a year.

Tars that accumulated on the metal and wooden screens used in the by-product (BP) and ammonia concentrate (AC) buildings were also disposed onsite roughly twice a year. Other miscellaneous solid waste material such as construction debris was also disposed onsite.

The water used to quench the hot coke was initially discharged to the nearby stream. After May 1923, the water was directed to a concrete-line sludge basin and allowed to separate. The upper "clean water" layer was discharged to the stream. The "lower liquid layer" was pumped from the basin into an injection well that was reportedly at the western corner of the sludge basin. The approximate location of the sludge basin and injection well are shown on Figure 2. The eight-inch diameter injection well was cased into rock at 200 feet bgs and has a total depth of 336 feet bgs. The sludge that accumulated in the bottom of the basin was reportedly removed to a holder near the AC building every six months prior to being disposed onsite or hauled to the city dump at the north end of Seneca Lake. This investigation will include an historical records review to locate the former city dump and to evaluate the historic disposal record.

Based on the well location data available on the USGS' website, the former injection well is near the former purifier building. While the reported location is near the former sludge basin, the second potential location will be investigated during this SRI.

Water discharging from the cooling coils and turbines was piped through underground lines to an open holding area. Most of this water evaporated because it had a very high temperature. The remaining water was discharged to the local stream.

Initial Field Investigation Program (1987)

During the 1987 Task 2 investigation, TRC:

- Excavated 43 test pits;
- Collected soil samples from the test pits;
- Advanced nine soil borings;
- Installed six monitoring wells;
- Collected air quality samples;
- Collected 15 sediment and 15 surface water samples from the onsite streams; and
- Collected three rounds of groundwater and surface water samples.

The six monitoring wells were installed as well pairs consisting of a shallow well to monitor shallow groundwater quality and a deep well to monitor the deeper aquifer water quality. Well pair MW-1S/MW-1D is to the north and upgradient of the site. Well pair MW-2S/MW-2D is south of the site at the base of a railroad bed. Well pair MW-3S/MW-3D is southeast of the site. Monitoring well locations are shown on Figure 2. The shallow "S" wells are screened from approximately 3 to 13 feet bgs. The deep "D" wells screen the sand unit beneath the first semi-confining clay layer at a depth of about 100 feet bgs.

The shallow soil borings were drilled in the area of a proposed storage building near the southwest corner of the service building. These shallow borings were drilled to a depth of between five and seven feet. All samples collected during Task 2 were analyzed for purgeable aromatic VOCs, PAHs, non-chlorinated phenols, and inorganics.

Expanded Problem Definition Program (1987)

During 1987, the Task 3 investigation by TRC:

- Advanced four soil borings and collected four composite samples;
- Collected ten surface soil samples, one purifier waste sample, five sediment samples (includes on duplicate sample), three surface water samples, ten groundwater samples (includes four duplicates);
- Probed the lake and stream sediments;
- Collected groundwater samples from monitoring wells; and
- Conducted an air quality survey in the crawl spaces of the former purifier building (presently the gas meter lab) and the compressor room building.

The soil, groundwater, and air samples collected during Task 3 were analyzed for purgeable aromatic VOCs, PAHs, non-chlorinated phenols, metals, organic nitrogen, and or cyanides (total and ferro-ferric).

The two streams were probed where the natural streambed exits the park. Probing resulted in oil films floating to the surface. The sediments in the western stream exhibited a coal tar-like odor.

The sediments in Seneca Lake were also probed approximately 250 feet east and west from both points where the site streams enter the lake. No oil sheens were observed during probing of the lake sediments. Two composite sediments from the lake were collected from near the eastern stream outlet.

The air quality survey was conducted using an organic vapor analyzer (OVA) in two crawl spaces that site workers occasionally enter to maintain plumbing systems. The three-foot crawl space beneath the compressor building has a dirt floor. The crawl space beneath the former purifier building has a concrete floor and contains three concrete bins that were used during coking operations. No readings above ambient levels were detected in the purifier building crawl space. A slight coal tar odor was noted in the crawl space of the compressor building. However, readings of only 2 ppm above ambient air were detected at only two locations in the compressor building crawl space.

Risk Assessment (1989)

The risks to public health and the environment associated with the past disposal activities at the site were assessed by TRC in Task 4. The site conditions and usage were considered in the risk assessment. The risk assessment was conducted following guidelines established by the National Academy of Sciences, the USEPA, and previous risk assessments performed at other sites in New York. Based on the risk assessment, TRC recommended that a health and safety plan, which should include an air monitoring program, be developed and followed by maintenance and other workers at the site during excavation work.

Focused Environmental Site Investigation (1993)

In 1993, Blasland & Bouck Engineers, P.C. (BBE) conducted a focused environmental site investigation. During this investigation, BBE:

- Excavated twenty test pits east of the eastern onsite creek (opposite the identified disposal area that is on the west side of the creek) to evaluate whether there were MGP residues east of the creek; and
- Installed two overburden monitoring well pairs near the eastern property line.

No disposal areas were identified east of the creek. The test pits were one to two feet deep and were excavated between the creek and the power line corridor. There was no evidence of MGP residues in any of the 20 test pits. Slag and railroad bed cinders were noted in some of the five test pits, which were excavated near an old railroad spur bed. Soil samples from three test pits (TP-93-1, TP-93-2, and TP-93-3) were collected and analyzed for VOCs (Method 8240), SVOCs (Method 8270), metals, and cyanide. The locations of these soil samples are shown on Figure 4.

The two well pairs (MW-4S/MW-4D and MW-5S/MW-5D) consist of a deep overburden and a shallow overburden well. Monitoring well locations are shown on Figure 2. The two shallow overburden wells screen the upper ten feet of saturated soil. The water table was encountered at approximately 2.5 feet bgs. The deep overburden wells screen a more permeable zone between 16 and 25 feet bgs.

Summary of Analytical Data

A summary of the analytical data generated during these investigations has been presented on Figures 3 through 6. The locations of the off-site sampling locations are more accurately shown on Figure 7. The groundwater data presented on Figure 3 shows the most recent analytical data gathered by NYSEG on June 18-19, 2001, and has been summarized for the purposes of this discussion.

Only cyanide was reported at four of the ten groundwater monitoring well samples during the 2001 sampling round. The highest concentration of cyanide (7.31 mg/L) was reported for the groundwater sample collected from MW-2S, which is downgradient of the former MGP facility and coke ovens. The results from this latest round of groundwater sampling appear to be consistent with the historical data provided by NYSEG.

The results of the surface soil analysis are summarized on Figure 4. The majority of the data presented on this figure is from sampling conducted in 1986, with additional samples collected in 1993. Three (SS-1, SS-2, and TP-41A) of the samples collected exhibited total SVOC concentrations in excess of 500 mg/kg. Two of the samples, SS-1 and SS-2, located on the western side of the former MGP facility, were collected from the area of a known relief holder and reported coal tar seeps. The results of the VOC analyses do not show any significant concentrations of VOCs in the surface soils at the site. Reported cyanide concentrations were elevated across the site, with the highest concentration reported for soil sample SS-6 (4,570 mg/kg). This sample was collected directly east of the former purifier building where elevated concentrations of cyanide are known to be present in the oxide boxes in the crawl space of the current building. Elevated concentrations of cyanide are also present in the vicinity of the stream located to the east of the property.

The results of the subsurface sampling are summarized on Figure 5. Subsurface soil samples collected at the site exhibit similar trends to those seen in the surface soils. However, in the case of the subsurface soils, several samples exceeded the recommended soil cleanup objective of 10 mg/kg for total VOCs. The highest concentration of VOCs was reported for the sample collected at TP-1 (669 mg/kg), which is located at the former relief holder on the west side of the MGP facility. The highest concentration of SVOCs was also found at sample location TP-1 (139,000 mg/kg). The highest concentration of cyanide was reported at TP-31, near the eastern relief holder (34,000 mg/kg). Several samples exceeding 10,000 mg/kg for cyanide were also reported for samples collected around the former purifier building. Elevated cyanide concentrations in excess of 1,000 mg/kg in soils were also reported for the samples collected from the eastern waste disposal area and the eastern side of the MGP facility.

The surface water and sediment sample results are summarized on Figure 6. While elevated concentrations of cyanide were found in several of the sediment samples, the results of greatest significance are those from the eastern stream. Concentrations of cyanide were found in excess of 50 mg/kg, with the highest concentration reported at SD-1. This sampling location is north of the former relief holder and northeast of the former purifier building. Each of the surface water samples collected had detected concentrations of cyanide. The highest concentration of cyanide in surface water was at SW-2 (23 µg/L), which is downstream of the eastern disposal area.

2.5 CONCEPTUAL SITE MODEL

Based on the historical information gathered through the previous phases of investigations, URS developed a conceptual site model. As shown on Figure 8, several routes of potential contaminant migration from the site exist or are suspected to have existed during the time of MGP operations.

Three large relief holders were previously located on site, which would have had an accumulation of residual materials at their base. These residual materials potentially migrated through the base of the holders impacting the subsurface soils and shallow groundwater. Based on the boring log information, the clay and silt beneath the fill material acts as a confining layer, limiting the downward migration of tar. Furthermore, utility trenches may provide preferential contamination migration pathways on-site.

Historical records have also indicated that waste materials were discharged directly to the streams adjacent to the site where contaminants accumulated in stream sediments. The streams may have transported the materials to Seneca Lake.

Other shallow potential sources of contamination at the site include:

- The former sludge basin, which was used for the separation of waste materials before discharge to the bedrock injection well and surface water bodies;
- The purifier building and the oxide boxes, which are known to contain high concentrations of cyanide;
- The former machine shop and other former manufacturing structures;
- Onsite waste disposal areas east of the historic MGP site and the associate surface water run-off from these areas; and
- The former relief holders.

Currently, the only suspected source of contamination to the bedrock is the former injection well. As stated earlier, the injection well was used for the disposal of waste from the sludge basin.

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 available historic documents for the site.
- Further document the groundwater and soil quality upgradient of the site.
- Evaluate the nature and extent of contamination related to MGP activities on the site.
- Evaluate the relationship between groundwater and surface water, specifically the drainage of surface water from the site to Seneca Lake via two onsite streams.
- Locate the former injection well.
- Evaluate the impacts of the former injection well.
- Evaluate the characteristics of bedrock beneath the site to assess potential contaminant migration pathways.
- Characterize groundwater quality in the overburden and bedrock regimes beneath the site.
- Evaluate the soil quality in areas of the site associated with past disposal practices or run-off from the site.

- Evaluate the surface soil quality near of the former MGP operations.

- Evaluate the quality of sediments in the wetlands and nearby streams.

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. In order to reduce the number of required investigation points, URS intends that the work plan be completed in a flexible manner. Therefore, an initial phase of investigation will be completed utilizing screening level data such as visual observations and photoionization detector (PID) readings. These data will be used to focus the placement of monitoring wells and guide the selection of soil samples for laboratory analysis.

3.2.1 Investigation

Based on the nature of coal tar constituents, the possible modes of release, and the local geology, the vertical extent of the MGP-related constituents is probably limited to either the former MGP structures themselves, along on-site utility trenches in the shallow groundwater system above the semi-confining unit identified at the site, or in the bedrock in the areas near and downgradient of the screened intervals of the former onsite injection well. 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.

The site has been divided into five sub-areas to aid in discussion of the data needs. The five areas are the:

- Historic MGP site;
- Eastern waste area;
- Backwater area;
- Western property extension; and
- Off-site environs.

Each of the sub-areas are identified on Figure 2, which 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 1.

3.2.2 Analytical Program

Table 2 summarizes the laboratory analytical program for this investigation. Samples collected during this phase of the SRI will be analyzed by Severn Trent Laboratories (STL) in Connecticut, a New York State ASP Laboratory. STL will provide ASP Category B Quality Assurance/Quality Control (QA/QC) deliverables package for analytical data.

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 included VOCs (primarily BTEX), SVOCs (PAHs and phenols), cyanides, and metals. Samples collected for analysis during the SRI will be analyzed for PAHs, total phenols, BTEX, metals (Al, Sb, As, Ba, Cd, Cr, Cu, Fe, Pb, Ni, Mn, Hg, Se, Ag, Vn, and Zn), PCBs, total organic carbon, and total cyanides.

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 the highly toxic free cyanide or cyanide salts, but rather are stable cyanide-iron complexes that have little toxicity (ERT and Koppers Company, 1984). In the case of the Geneva-Border City site, a significant potential source of cyanide exists in the area of the Former Oxide Boxes.

In addition, selected groundwater samples will be analyzed for alkalinity, dissolved total organic carbon, nitrate/nitrite, sulfate/sulfide, 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, groundwater samples from monitoring wells will be analyzed for target compound list (TCL), VOC, and SVOC parameters. The samples selected for these analyses will be based on past practices (such as the former machine shop) and potential off-site contaminant sources (such as the scrap yard).

4.0 PROPOSED SRI SCOPE OF WORK

The scope of work consists of the following tasks:

Task 1 – Soil Borings and Hydropunch™ Sampling
Task 2 – Oxide Box Sampling
Task 3 – Monitoring Well Installation
Task 3A – Overburden Monitoring Well Installation
Task 3B – Bedrock Monitoring Well Installation
Task 4 – Groundwater Sampling
Task 5 – Surface Water and Sediment Sampling
Task 6 – Surface Soil Sampling
Task 7 – Analyze Data and Prepare Report

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

Non-aqueous phase liquids may be encountered during various phases of this SRI, specifically during soil boring and well installations. 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, 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. 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.

4.1 TASK 1 – SOIL BORINGS AND HYDROPUNCHä SAMPLING

The focus of this task will be to delineate the distribution of contaminants in the subsurface. URS will advance soil borings for the purposes of visually screening the subsurface materials, and collect selected soil and groundwater samples for chemical characterization. Table 1 presents the level of effort for each of the areas of investigation at the site.

A total of 46 soil borings will be installed using both Geoprobe and conventional drill rig methods. Geoprobe borings will be advanced in the Eastern Waste Disposal Area, the Backwater Area, and the Off-Site Environs. A Geoprobe drill rig will likely not be capable of penetrating the subsurface fill materials and basement structures of the former MGP facility. Therefore, a conventional drill rig with 4-1/4 inch ID hollow stem augers will be utilized for sample collection in the Historical MGP Manufacturing Area and the Western Property Extension. The drilling procedures are described in the *FSP* (Appendix C).

GeoprobeÔ Borings

A total of 22 soil borings (GP-1 through GP-22) will be advanced in three areas using a Geoprobe™ or equivalent direct push equipped rig. As shown on Figure 9 and on Table 3, soil borings GP-1 through GP-7 will be advanced in the Off-Site Environs, borings GP-8 through GP-15 will be advanced in the Eastern Waste Disposal Area, and borings GP-16 through GP-22 will be advanced in the Backwater Area. Each of the proposed soil borings will be advanced to a depth of approximately four to eight feet. These borings will be limited to this depth range since the purpose of these borings is to investigate the distribution of MGP related contamination associated with past surface and near surface disposal practices, or run-off from the site. However, based on the field observations, the depth of each boring may be advanced deeper until evidence of site contaminants is no longer evident.

The 22 Geoprobe borings will be advanced utilizing a four-foot long discrete sampler, which will be pushed using the hydraulic rams of the Geoprobe rig. Soil samples will be collected using a four-foot MacroCore open sampler from the zero to four foot interval. Once at the appropriate depth, the 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.

All soil borings will be screened using a PID and placed in sample jars for potential analysis. Once all of the 22 GeoProbe borings are advanced, a total of 14 samples will be selected and submitted for laboratory analysis from 11 of the soil borings.

One sample will be submitted for laboratory analysis from eight of the 22 borings. This sample will be collected from the two-foot interval below the highest level of visual and field screening. If no contamination is observed during field screening, the sample will be collected from the two-foot interval corresponding to the water table or bottom of the boring, whichever is shallowest.

Two soil samples will be submitted for laboratory analysis from a boring from each of the three areas (off-site environs, eastern waste area, and the backwater area) that exhibits the greatest level of contamination based on field screening, see Table 3. In borings where two samples are submitted for laboratory analysis, one soil sample will be collected from the two-foot interval exhibiting the highest levels of contamination based on field screening. The second sample will be collected from the two-foot interval directly below the area exhibiting elevated levels of contamination.

Each of the soil samples submitted to the laboratory will be analyzed for BTEX (USEPA Method 8260B), PAHs (USEPA Method 8270C), PCBs (USEPA Method 8082), total phenols (USEPA Methods 9065/420.2), metals (USEPA Methods 6010/7470), and total cyanide (USEPA Method 335.3), in addition, approximately half of the samples will be analyzed for total organic carbon (TOC) as shown in Table 2. The analytical data generated from Geoprobe soil sampling will be reported by the laboratory with ASP Category B QA/QC deliverables. The soil sampling procedures are more fully described in the *FSP* (Appendix C) and *QAPP*.

Following completion of each soil boring, the boring will be backfilled to the surface with cement-bentonite grout or bentonite pellets.

Conventional Drill Rig Soil Borings

A conventional drill rig will be used to advance a total of 24 soil borings (SB-1 through SB-24) in two areas of the site. Soil borings SB-1 through SB-21 will be advanced in the Historical MGP Manufacturing Area, and soil borings SB-22 through SB-24 will be advanced in the Western Property Extension. These 24 borings will be drilled at least ten feet into the silty clay layer (approximate total depth of 30 feet bgs). However, based on the field observations, the depth of each boring may be advanced deeper until evidence of site contaminants is no longer evident.

Continuous soil samples will be collected using a two-inch diameter, two-feet long split spoon sampler for visual characterization and field screening using a PID and placed in sampling containers for potential analysis. The soil samples that are selected for laboratory analysis will be chosen in the field based on field screening results as outlined below. At least one sample will be selected for laboratory analyses from each of the twelve potential source areas as shown on Table 3. If the extent of contamination is significant, then additional samples may be submitted for laboratory analysis.

A total of 15 samples will be collected for laboratory analysis from 12 of the 24 soil borings. Two soil samples will be submitted for laboratory analysis from three of the borings. One sample will be submitted to the laboratory for analysis from nine borings. Once all of the borings are completed in each of the twelve areas listed on Table 3, samples will be selected and submitted from the boring exhibiting the greatest levels of contamination. If no contamination is observed in any of the borings in an investigation area, then the sample will be collected from the presumed downgradient (south) side of the area.

In borings from which one sample will be submitted for laboratory analysis, a sample will be collected from the interval below the highest level of contamination. The purpose of collecting the sample beneath the area of greatest observed impacts is to assess the vertical extent of contamination. If no contamination is observed during field screening, the sample will be collected from the interval corresponding to the water table or bottom of the boring, whichever is shallowest.

Three samples of NAPL saturated soils will be submitted from borings in which NAPLs are observed. This soil sample will be collected from the interval exhibiting the highest levels of contamination based on field screening. At locations where NAPL is observed a soil sample will be collected from below the area exhibiting elevated levels of contamination for confirmation of vertical limits.

Each of the soil samples submitted to the laboratory will be analyzed for BTEX (USEPA Method 8260B), PAHs (USEPA Method 8270C), PCBs (USEPA Method 8082), total phenols (USEPA Methods 9065/420.2), metals (USEPA Methods 6010/7470), and total cyanide (USEPA Method 335.3), in addition, approximately half of the samples will be analyzed for TOC, as shown in Table 2. The analytical data generated from soil sampling from borings advanced by a conventional drill rig will be reported by the laboratory with ASP Category B QA/QC deliverables. The soil sampling procedures are more fully described in the *FSP* (Appendix C) and *QAPP*.

Following the completion of each of the borings, if the boring is not to be used as a monitoring well location as described in Section 4.3, the boring will be backfilled to the surface with cement-bentonite grout or bentonite pellets. Otherwise, the boring will be completed as a monitoring well. All soil generated during the advancement of the borings will be containerized and stage onsite at a location designated by NYSEG for later disposal.

Hydropunchä Samples

In addition to the collection of soil samples from the soil borings, URS will also collect 17 groundwater samples using Hydropunch™, or equivalent equipment for the purposes of screening the shallow groundwater and supplementing analytical data collected from monitoring wells in the overburden. One groundwater sample will be collected from the soil borings that are not to be completed as monitoring wells. Specifically, the Hydropunch™ samples will be collected during the boring investigation from locations SB-1, SB-3, SB-4, SB-6, SB-7, SB-8, SB-9, SB-11, SB-12, SB-14, SB-15, SB-16, SB-18, SB-20, SB-22, SB-23, and SB-24. The proposed locations of the groundwater monitoring wells will be finalized based on the screening results (visual and PID) of the Hydropunch™ groundwater sampling. A discussion of the proposed monitoring well installation program is presented in Task 3 (Section 4.3).

Each of the 17 Hydropunch™ groundwater samples will be submitted to the laboratory and analyzed for BTEX (USEPA Method 8260B), PAHs (USEPA Method 8270C), PCBs (USEPA Method 8082), total phenols (USEPA Methods 9065/420.2), metals (USEPA Methods 6010/7470), and total cyanide (USEPA Method 335.3) as shown in Table 2. The analytical data generated from Hydropunch™ sampling will be reported by the laboratory with ASP Category B QA/QC deliverables. The Hydropunch™ sampling procedures are described in the *FSP* (Appendix C) and *QAPP*.

4.2 TASK 2 – OXIDE BOX SAMPLING

In 1985, a single composite sample of the solids material was collected from the oxide boxes in the basement area of the current gas meter laboratory. The analytical results for total cyanide and total iron from the sample collected in 1985 had a concentration of total cyanide of 2,280 mg/kg. The concentration of total iron was 5,140 mg/kg. It was also reported that water is present in the basement area and is in contact with waste materials in the oxide boxes.

In order to verify the results of the previous sampling, two samples will be collected from the oxide boxes. One sample will be collected from the solid materials present in one of the boxes and the other sample will be collected from the liquid present.

The samples will be collected via the access panels in the floor of the meter laboratory. At no time will personnel enter the former oxide boxes. Since access within the building is limited, work associated with this task will be completed after 5:00 PM in the afternoon or at a time convenient to the facility. The liquid sample will be collected first so as to limit the disturbance of the particulate material present, which would cause an increase in the turbidity and result in increased concentrations in the liquid phase. The liquid sample will be collected using either a dedicated bailer or a beaker. Once collected, the liquid sample will be transferred to a laboratory sample jar. Following the completion of the liquid sampling, the solid sample will be collected using a hand auger. A composite sample will be collected from the top of the solid material to its base. The sampled material will be placed on a sheet of plastic and the material mixed to ensure the sample has been homogenized. The material will then be transferred to a laboratory sample jar.

Each sample will be analyzed for PAHs (USEPA Method 8270C), metals (USEPA Methods 6010/7470), total cyanide (USEPA Method 335.3), and reactivity, as shown in Table 2. The analytical data generated from oxide box sampling will be reported by the laboratory with ASP Category B QA/QC deliverables. The oxide box sampling procedures are described in the *FSP* (Appendix C) and *QAPP*.

4.3 TASK 3 –MONITORING WELL INSTALLATION

Both overburden and bedrock monitoring wells will be installed to evaluate the extent of groundwater contamination at the site. The following sub-tasks discuss the methods of investigation for both hydrogeologic regimes.

Sub-Task 3A – Overburden Monitoring Well Installation

Ten overburden monitoring wells (OB-6 through OB-15) will be installed to evaluate the quality of the overburden groundwater. The proposed locations of overburden monitoring wells are shown on Figure 9. These locations may be modified based on the results of the soils investigation. One monitoring well will be placed in one of the two soil borings in each of the former MGP structures. The specific location will be based on the field screening. Therefore, the borings near each of the structures will remain open until both borings are completed (no more than one field day).

One overburden monitoring well (OB-7) will be installed in the Eastern Waste Disposal Area. Eight overburden monitoring wells (OB-6, OB-8, OB-9, OB-10, OB-11, OB-12, OB-13, and OB-14) will be installed in the Historical MGP Manufacturing Area. One overburden monitoring well (OB-15) will be installed in the Western Property Extension to assess the potential of contaminant migration onto the site from upgradient locations.

The overburden wells will be installed in the boreholes advanced under Task 2 where these locations overlap. Where the soil borings and monitoring well locations coincide, each proposed overburden monitoring well will be advanced using 4-1/4 inch hollow stem augers to a depth of approximately 30 feet below the ground surface (i.e., no split-spoon samples will be collected). When well locations do not coincide with boreholes, specifically the upgradient monitoring well OB-15, the monitoring well placed at the approximate location of the former injection well (OB-9), and the monitoring well placed at a previous Geoprobe location (OB-7), continuous split-spoon samples will be collected to the bottom of the borehole.

Once at the proposed completion depth, the monitoring wells will be constructed through the annular space of the hollow stem augers. Each well will be constructed of schedule 40 two-inch diameter PVC screen (approximately ten feet in length) and riser pipe to the surface. The annular space surrounding the well screen will be backfilled with filter sand to a minimum of two feet above the screen. A minimum two-foot thick layer of bentonite pellets will then be emplaced and allowed to hydrate. The remainder of the boring will be sealed using a cement-bentonite grout. At this time, we anticipate that all wells will be completed with stick-up protective casings. Upon installation, the wells will be developed using a combination of surging and pumping. Each well will be developed until approximately ten well volumes have been removed. Water removed during development will be containerized and staged at a location designated by NYSEG for future disposal. Well construction and well development procedures are described in the *FSP*.

Sub-Task 3B – Bedrock Monitoring Well Installation

A review of the historical data for the site indicates that liquid from a settling pond located along the present day southern fence line was discharged to a bedrock injection well. However, the exact location of this injection well is unknown. One location as reported by TRC is adjacent to the southern fence line. This location also appears to have been verified following a review of historical photographs. If it is determined that the injection well was a significant source of contamination to the environment, and is still an environmental liability, URS recommends locating and abandoning the former injection well as part of a remedial action for the site.

Prior to initiating the bedrock investigation, a geophysical survey will be conducted to attempt to find the former injection well. The geophysical survey will consist of a magnetic survey followed by a confirmatory ground penetrating radar (GPR) survey. The area identified as the most likely location will be excavated to a depth of up to ten feet bgs.

In order to investigate the distribution of contaminants in the bedrock regime, four bedrock monitoring wells (BR-1 through BR-4) will be installed. The locations of proposed bedrock monitoring wells BR-1, BR-2, and BR-3 are presented on Figure 9. The location of off-site bedrock monitoring well BR-4 is shown on Figure 10. Proposed monitoring well BR-1 will be installed upgradient of the historical MGP operations, at the existing monitoring well MW-1 cluster. The second well (BR-2) will be located at the eastern edge of the property in the vicinity of the former relief holder and in the area of proposed monitoring well OB-6. One well will be installed at the suspected location of the former injection well (BR-3). The fourth and final bedrock monitoring well (BR-4) will be located in the State Park adjacent to Seneca Lake (Figure 10). This location will be utilized to evaluate the downgradient extent of contamination, if any, in the bedrock groundwater prior to discharge to Seneca Lake.

For each bedrock monitoring well, a boring will be advanced through the overburden materials using drive and wash 6-inch steel casing. Standard split spoon sampling will be conducted continuously for the upper 40 feet of BR-2 and BR-3. Thereafter, split-spoon samples will be collected at 10 foot intervals to the top of bedrock. No split-spoon samples will be collected at bedrock monitoring well locations BR-1 and BR-4. The temporary casing will be seated into the top of the bedrock. Based on previous reports, the top of bedrock is estimated to be at approximately 175 to 200 feet bgs. Once the casing has been seated into the bedrock, the lower portion of the well will be advanced into the bedrock using NX (three-inch OD) coring.

The proposed bedrock wells will be drilled to a total depth of approximately 336-feet below grade, which is the reported construction depth of the former injection well plus an additional ten feet. During the advancement of wells BR-2 and BR-3, packer sampling will be conducted in bedrock at approximately 30-foot intervals to measure the hydraulic properties of the bedrock and to collect groundwater samples for screening of MGP-related contaminants (SVOCs).

No packer sampling will be conducted during drilling of proposed monitoring wells BR-1 and BR-4. Based on the analytical results of packer samples at wells BR-2 and BR-3, a determination will be made as to the total depth and open-hole intervals of the remaining bedrock monitoring wells (BR-1 and BR-4), and the appropriate length of the open bedrock interval. However, these wells will also be advanced using NX core.

Once at the anticipated completion depth, caliper logging will be conducted for the length of the open bedrock hole. This will be completed to support the visual logging of the bedrock case. The need for additional geophysical methods will be evaluated at a later date and will be selected in consultation with the NYSDEC.

When the desired depth for each bedrock monitoring well is reached, the borehole will be reamed to a nominal six-inch diameter at the top of the desired open interval. Following reaming, a four-inch PVC riser pipe will be grouted into the borehole and allowed to cure for a minimum period of 48 hours prior to reentering the well to ream the lower portion of the well to a nominal four-inch diameter.

Development of each bedrock well will be accomplished using the drilling rig tools. All drill cuttings and water generated during the advancement and development of the well will be containerized and staged at a location designated by NYSEG. Drilling, well construction, packer testing, and well development methods are described in the *FSP* (Appendix C).

4.4 TASK 4 – GROUNDWATER SAMPLING

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.

Groundwater samples will be collected from each of the bedrock and overburden monitoring wells installed during the SRI (BR-1 through BR-4; OB-6 through OB-15), along with the existing monitoring wells which were installed during previous investigations (MW-1S/1D through MW-5S/5D), a minimum of two weeks following installation and development of the last SRI well. Approximately three to five well volumes of water will be removed from each well prior to sampling (unless the well is pumped dry). A peristaltic or hydrolift pump will be used to purge the overburden wells, and a submersible pump will be used to purge the bedrock wells. The purge water generated will be containerized and staged at an on-site location designated by NYSEG. Field parameters, which include temperature, pH, conductivity, and turbidity of the samples, will be recorded during the purging process. Once the field parameters have stabilized (to within 10 percent), water samples will be collected directly from the pump effluent.

All groundwater samples will be collected within 24 hours of purging of the well. A total of 24 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. To minimize the collection of turbid samples, SVOCs and metals samples will be collected after the wells have stablized for approximately two hours. At this time, we have assumed that only unfiltered samples will be collected. Groundwater samples will be analyzed for BTEX (USEPA Method 8260B), PAHs (USEPA Method 8270C), PCBs (USEPA Method 8082), total phenols (USEPA Methods 9065/420.2), metals (USEPA Methods 6010/7470), total cyanide (USEPA

Method 335.3), nitrate, nitrite, sulfate, and sulfide as shown in Table 2. Groundwater samples from monitoring well locations BR-1 through BR-4, OB-7, OB-8, OB-9, and OB-10, and OB-15 will be analyzed for TCL VOCs (USEPA Method 8260B), and TCL SVOCs (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*.

4.5 TASK 5 – SURFACE WATER AND SEDIMENT SAMPLING

A total of 15 surface water and 34 sediment samples will be collected from 15 sampling locations (SW/SED-1 through SW/SED-15). The proposed sampling locations are presented on Figures 9 and 10. Three sampling locations (SW/SED-1 through SW/SED-3) will be from background locations that have not been impacted by the former MGP facility operations. Twelve sample locations (SW/SED-4 through SW/SED-15) are located adjacent to the facility and downstream of the site. As shown on Figure 10, a total of six of these 12 samples (SW/SED-10 through SW/SED-15) will be collected from the drainage pathways leading to Seneca Lake and from the discharge points at the Lake. At each sediment sampling location two samples will be collected. One will be collected from 0-6 inches and the second will be collected from 6-12 inches in depth. In addition to the surface water sampling locations identified above, two additional samples may be collected in the backwater area. These samples will be collected if significant water bodies are identified during the first week of field activities.

As shown in Table 2, the sediment samples will be analyzed for BTEX (USEPA Method 8260B), PCBs (USEPA Method 8082), total phenols (USEPA Methods 9065/420.2), metals (USEPA Methods 6010/7470), total cyanide (USEPA Method 335.3), and total organic carbon (TOC) (Lloyd Kahn Method). The surface water samples will be analyzed for the same parameters with the exception of BTEX and TOC and the addition of hardness. In addition, half of the samples will be analyzed for PAHs (USEPA Method 8270C) and the other half will be analyzed for the standard suite of SVOCs (USEPA Method 8270C).

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* (Appendix C) and *QAPP*.

4.6 TASK 6 - COLLECT SURFACE SOIL SAMPLES

A total of ten surface soil samples (SS-16 through SS-25) will be collected. The surface soil sampling locations are shown on Figure 9. Surface soil samples will be collected from either zero to two inches below the ground surface, or zero to six inches below the ground surface. The sampling depth will be based on the intended use of the data, the human health risk or ecological health risk, respectively. A breakdown of the proposed sampling depth is presented in Table 4. If vegetation is present, the samples will be collected zero to two inches below the root zone. Seven surface soil samples will be collected from the Eastern Waste Disposal Area (SS-16 through SS-22), and three samples will be collected from the western edge of the Historical MGP Manufacturing Area (SS-23 through SS-25). These samples will be collected to assist in evaluating potential exposure to the site soils. Surface soils will not be collected from other areas of the property since the soils in these areas are covered with asphalt, therefore limiting direct exposure to the surface soil.

An additional six surface soil samples (SS-26 through SS-31) will be collected from the "backwater" area south of the site. These six surface samples will be collected in conjunction with the six Geoprobe soil borings (GP-17 through GP-22) conducted in this area. Three surface soil samples (SS-32 through SS-34) will be collected from background locations. These background locations will be selected in consultation with NYSEG and the NYSDOH.

Each of the surface soil samples collected will be analyzed for PAHs (USEPA Method 8270C), PCBs (USEPA Method 8082), total phenols (USEPA Methods 9065/420.2), metals (USEPA Methods 6010/7470), and total cyanide (USEPA Method 335.3) as shown in Table 2. The analytical data generated from surface soil sampling will be reported by the laboratory with ASP Category B QA/QC deliverables. The surface soil sampling procedures are described in the *FSP* (Appendix C) and *QAPP*.

4.7 TASK 7 – ANALYZE DATA AND PREPARE REPORT

URS will perform data analysis throughout the project, which will be facilitated using a geographic information system (GIS). 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 the NYSDEC. Any variations in the scope of work or recommendations to change the scope of work will also be documented in the in the weekly progress reports which will be transmitted via email to the NYSEG project manager and the NYSDEC.

After the scope of work outlined in this workplan is complete, URS will prepare two copies of a draft report for submittal to the NYSDEC. 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. Supporting data, including the analytical data, boring logs, and field notes will be included in the draft report.

Geologic cross-sections will also be developed and included with the draft report. 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. Any other potential sources and potential preferential contaminant migration pathways that we identify will also be described.

The report will include a discussion of analytical data collected during the SRI and previous investigations. The *SRI Report* will include plan view isoconcentration maps and cross-sections that show the approximate extent of contamination, if applicable. These figures will show both the vertical and horizontal extent of specific contaminants, or suites of contaminants, that are present above applicable regulatory criteria or guidance values.

The available data will be evaluated at the conclusion of the *SRI* in order to complete a qualitative analysis of the potential risk of adverse effects on human health and fish and wildlife resulting from the presence of chemicals in, on, and near the Site. The fish and wildlife assessment 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, with the NYSDEC's agreement, will have the option to implement risk reduction remedies or conduct further, more detailed studies to support a baseline risk assessment.

The purpose of the assessment is to evaluate the potential risk of adverse effects of the chemicals on human health and the environment. The results of the risk assessment will be used as the basis for future risk management decisions that will reduce the potential risk associated with the site.

The *SRI Report* will include a list of conclusions based on our background review, the interpretation of geologic and hydrogeologic data, the analytical data, a qualitative human health risk assessment, and a fish and wildlife assessment.

5.0 SCHEDULE

Figure 11 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 SRI WORKPLAN

NYSEG - GENEVA-BORDER CITY FORMER MGP FACILITY

Area of Concern	**Task 1: Soil Boring Locations**		**Task 1: Hydro-Punch Sample Locations**		**Task 2: Oxide Box Samples**	
Historical MGP Manufacturing Area	21	SB-1 through SB-21	13	HP-1 through HP-13	2	BOX-1
Eastern Waste Disposal Area	8	GP-8 through GP-15	-	-	-	-
Western Property Extension	3	SB-22 through SB-24	3	HP-14 through HP-16	-	-
Backwater Area	7	GP-16 through GP-22	-	-	-	-
Off-Site Environs	7	GP-1 through GP-7	-	-	-	-
Total Number of Proposed Investigation Points	**46**	**-**	**16**	**-**	**2**	**-**

Area of Concern	**Task 3a: Overburden Monitoring Well Locations**		**Task 3b: Bedrock Monitoring Well Locations**		**Task 5: Surface Water/Sediment Locations**		**Task 6: Surface Soil Locations**	
Historical MGP Manufacturing Area	8	OB-6, OB-8 through OB-14	2	BR-2, BR-3	-	-	3	SS-23 through SS-25
Eastern Waste Disposal Area	1	OB-7	-	-	-	-	7	SS-16 through SS-22
Western Property Extension	1	OB-15	-	-	-	-	-	-
Backwater Area	-	-	-	-	-	-	6	SS-26 through SS-31
Off-Site Environs	-	-	2	BR-1, BR-4	15	SW/SED-1 through SW/SED-15	3	SS-32 through SS-34
Total Number of Proposed Investigation Points	**10**	**-**	**4**	**-**	**15**	**-**	**19**	**-**

TABLE 2

SUMMARY OF ANALYTICAL METHODS

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

Analytical Method	**Task 1: Soil Boring Samples**	**Task 1: Hydro-Punch Samples**	**Task 2: Oxide Box Samples**	**Task 4: Groundwater Samples**	**Task 5: Surface Water/ Sediment Samples**	**Task 6: Surface Soil Samples**
BTEX (EPA Method 8260B)	X	X		X	X (sediment samples only)	
VOCs (EPA Method 8260B)				X(1)		
PAHs (EPA Method 8270C)	X	X		X	X	X
SVOCs (EPA Method 8270C)				X(1)		
PCBs (EPA Method 8082)	X			X	X	X
Total Phenols (EPA Method 9065/420.1)	X	X		X	X	X
Metals(2) (EPA Methods 6010 and 7471)	X	X	X	X	X	X
Total Cyanide (EPA Methods 9012 and SM 4500I)	X	X	X	X	X	X
Alkalinity(3) (EPA Method 310.1)				X		
Chloride(3) (EPA Method 9250)				X		
Nitrate/Nitrite(3) (EPA Method 9200)				X		
Sulfate/Sulfide(3) (EPA Method 9035)				X		
Dissolved Iron (Field Filtered)(3) (EPA Method 6010)				X		
Acid Volatile Sulfide/Simultaneously Extracted Metals (SW846/6010)					X (two sediment samples)	
Total Organic Carbon (Lloyd-Kahn Method)				X	X	

Notes:

(1) Samples from selected locations will be analyzed for TCL VOCs and TCL SVOCs. Refer to Setion 4.4 of text.

(2) Metals include Al, Sb, As, Ba, Cd, Cr, Cu, Fe, Pb, Ni, Mn, Hg, Se, Ag, Vn, and Zn.

(3) Groundwater samples will be analyzed for geochemical indicators of natural attenuation from selected monitoring wells.

TABLE 3

SUMMARY OF SOIL BORING INVESTIGATION

NYSEG GENEVA-BORDER SITY
FORMER MGP FACILITY

Structure/Area	Soil Borings
GeoProbe^{TM} Borings	
Off-Site Environs	GP-1, GP-2, GP-3, GP-4, GP-5, GP-6, GP-7
Eastern Waste Area	GP-8, GP-9, GP-10, GP-11, GP-12, GP-13, GP-14, GP-15
Backwater Area	GP-16, GP-17, GP-18, GP-19, GP-20, GP-21, GP-22
Hollow-Stem Auger Borings	
Eastern Holder Area	SB-1*, SB-2
Purifier House	SB-3*, SB-4*
Eastern Tar Storage Vessel and Machine Shop	SB-5, SB-6*
By-Products Building	SB-7*
Power House/Solvey Ovens	SB-8*, SB-9*
Ammonia Concentrate Building and Tar Vessel	SB-10, SB-11*
Ammonia Tanks	SB-12*
Northern Holder Area	SB-13, SB-14*
Blue Gas Building	SB-15*
Western Holder Area	SB-16*, SB-17
Western Tar Storage Vessel	SB-18*, SB-19
Western Property Extension	SB-20*, SB-21, SB-22*, SB-23*, SB-24*

Notes:

* - Indicates a groundwater sample will be collected using a Hydropunch^{TM} type sampler.

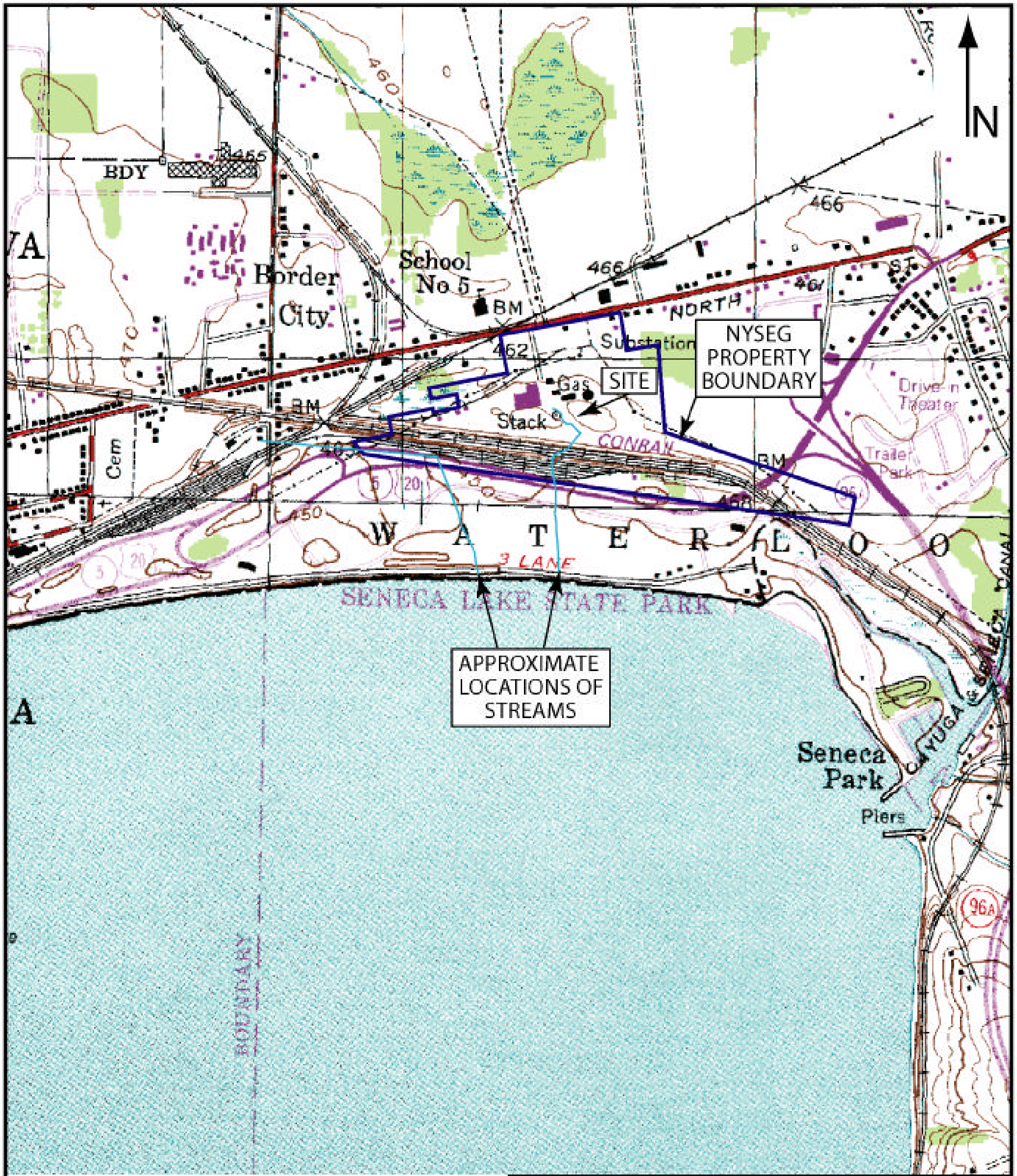
TABLE 4

PROPOSED INTENDED USE BREAKDOWN FOR SURFACE SOIL SAMPLES

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

Sample Location	Human Health Risk	Ecological Health Risk
SS-16		X
SS-17		X
SS-18	X	
SS-19		X
SS-20		X
SS-21		X
SS-22	X	
SS-23	X	
SS-24	X	
SS-25	X	
SS-26	X	
SS-27		X
SS-28	X	
SS-29		X
SS-30	X	
SS-31		X
SS-32	X	
SS-33		X
SS-34	X	

Note: Surface soil samples collected for Human Health Risk Evaluation will be collected from 0-2" below the ground surface.
Surface soil samples collected for Ecological Health Risk Evaluation will be collected from 0-6" below the ground surface.



SITE

NYSEG PROPERTY BOUNDARY

APPROXIMATE LOCATIONS OF STREAMS

GRAPHIC SCALE (FEET)

0 600 1200 1800 2400

SOURCE: USGS GENEVA NORTH AND GENEVA SOUTH
7.5' TOPOGRAPHIC MAPS

FIGURE
1

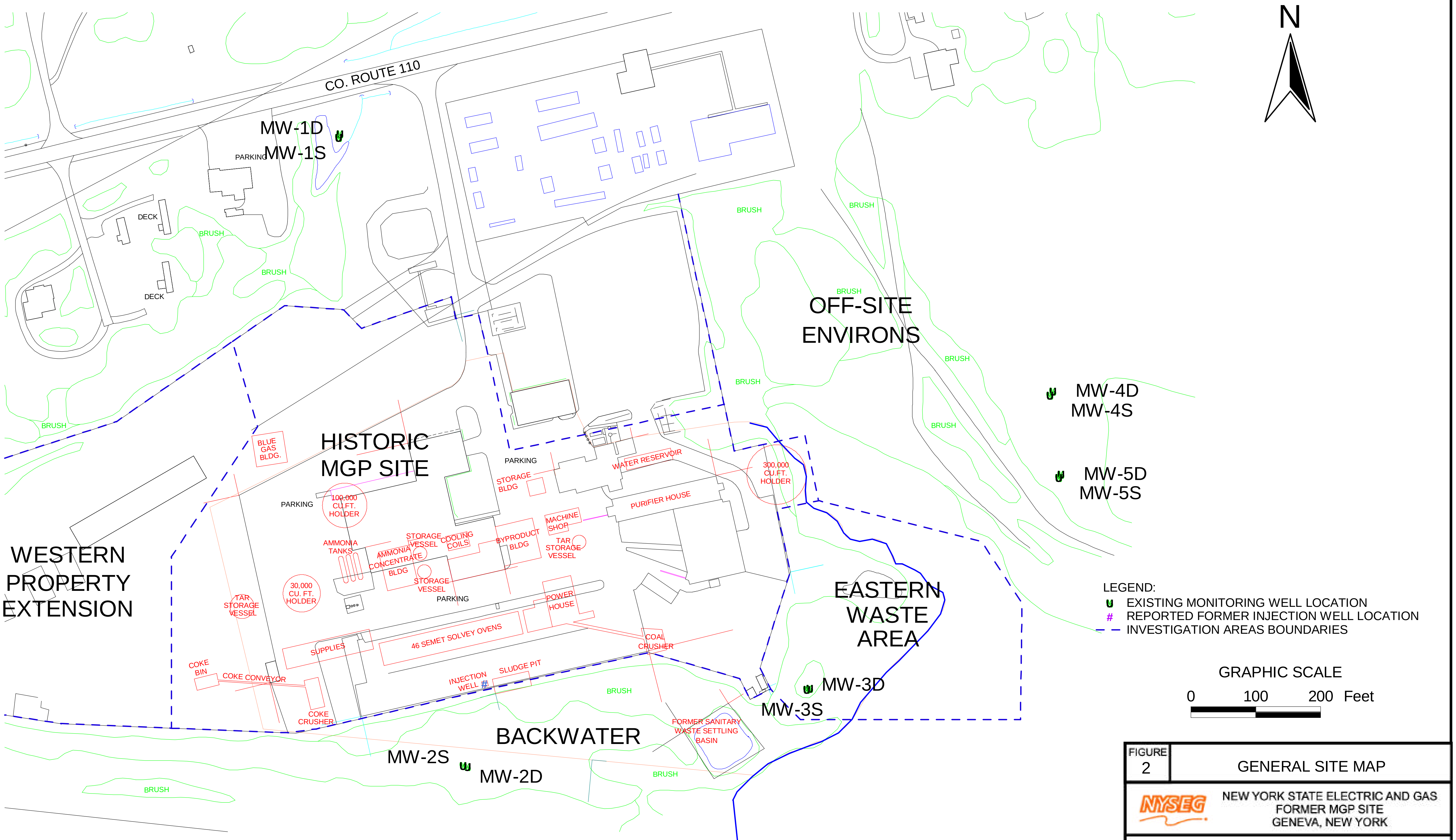
SITE LOCATION MAP

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065



LEGEND:
- U EXISTING MONITORING WELL LOCATION
- # REPORTED FORMER INJECTION WELL LOCATION
- – – INVESTIGATION AREAS BOUNDARIES

FIGURE
2

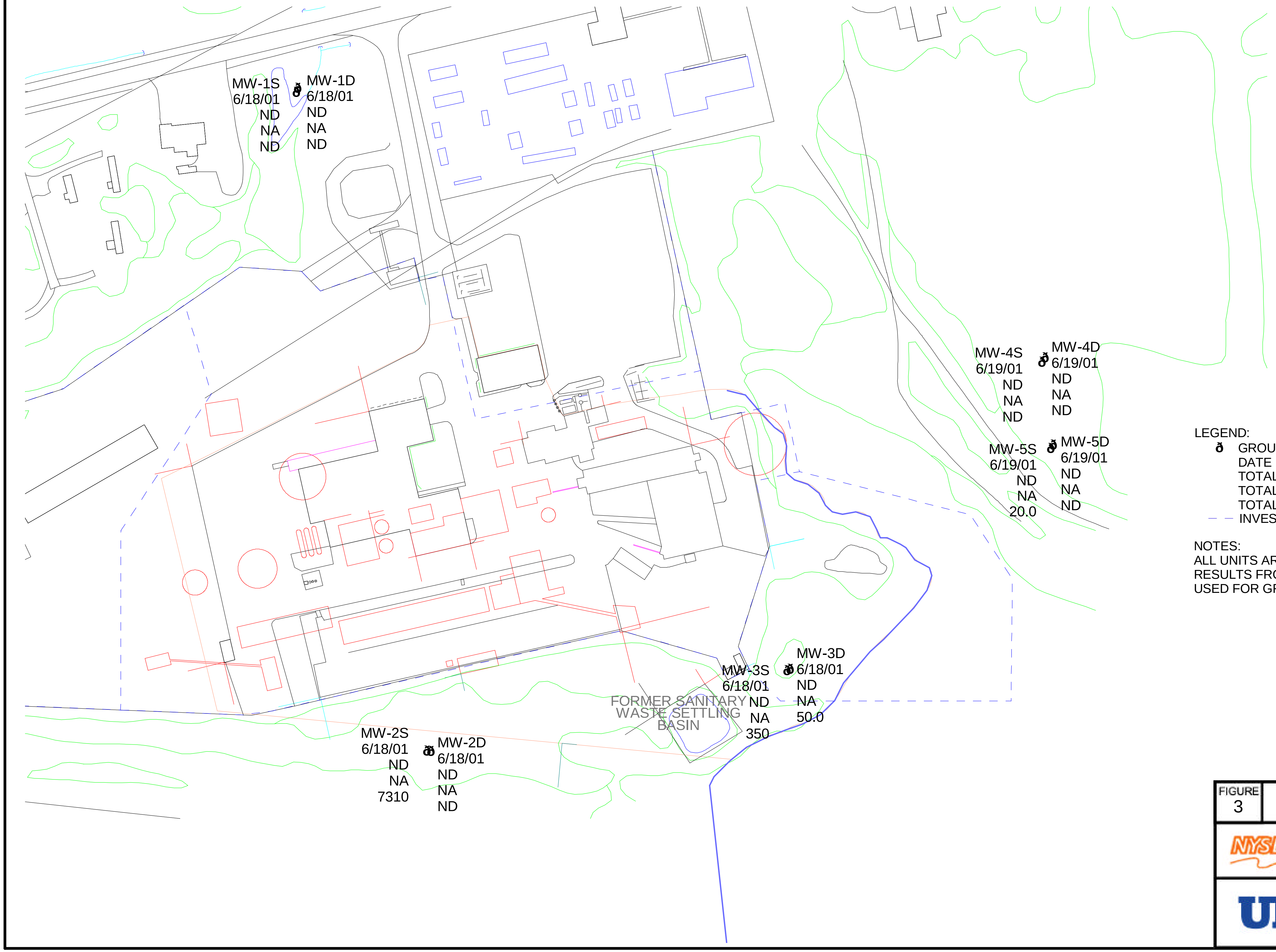
GENERAL SITE MAP

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065



LEGEND:
ŏ GROUNDWATER SAMPLING LOCATIONS
DATE
TOTAL VOCS
TOTAL SVOCS
TOTAL CYANIDE
– – INVESTIGATION AREAS BOUNDARY

NOTES:
ALL UNITS ARE ug/L.
RESULTS FROM THE LATEST SAMPLING ROUND WERE USED FOR GROUNDWATER SAMPLING RESULTS.

FIGURE
3

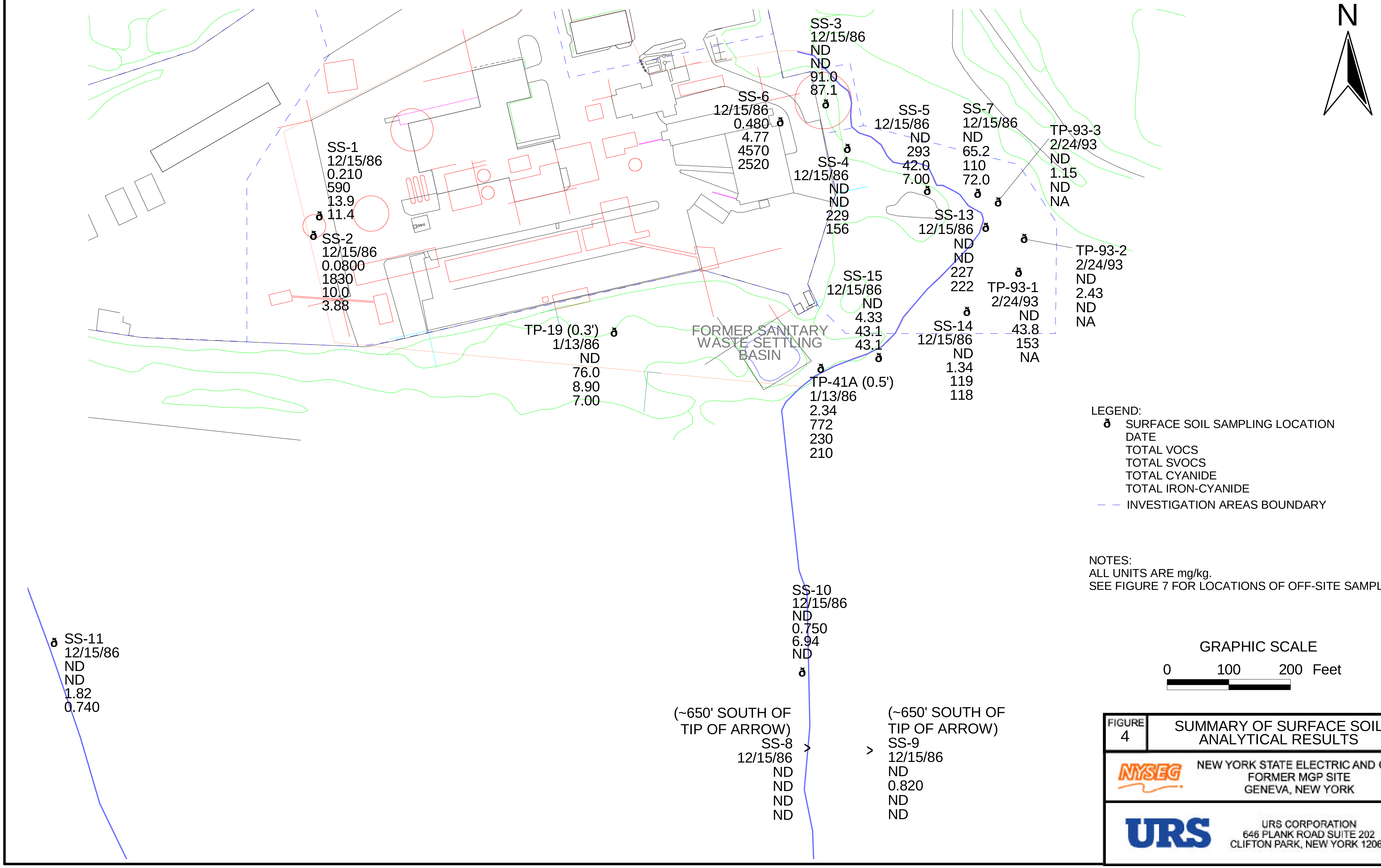
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065



LEGEND:

- ð SURFACE SOIL SAMPLING LOCATION
  DATE
  TOTAL VOCS
  TOTAL SVOCS
  TOTAL CYANIDE
  TOTAL IRON-CYANIDE
- – – INVESTIGATION AREAS BOUNDARY

NOTES:
ALL UNITS ARE mg/kg.
SEE FIGURE 7 FOR LOCATIONS OF OFF-SITE SAMPLES.

GRAPHIC SCALE
0 100 200 Feet

FIGURE
4

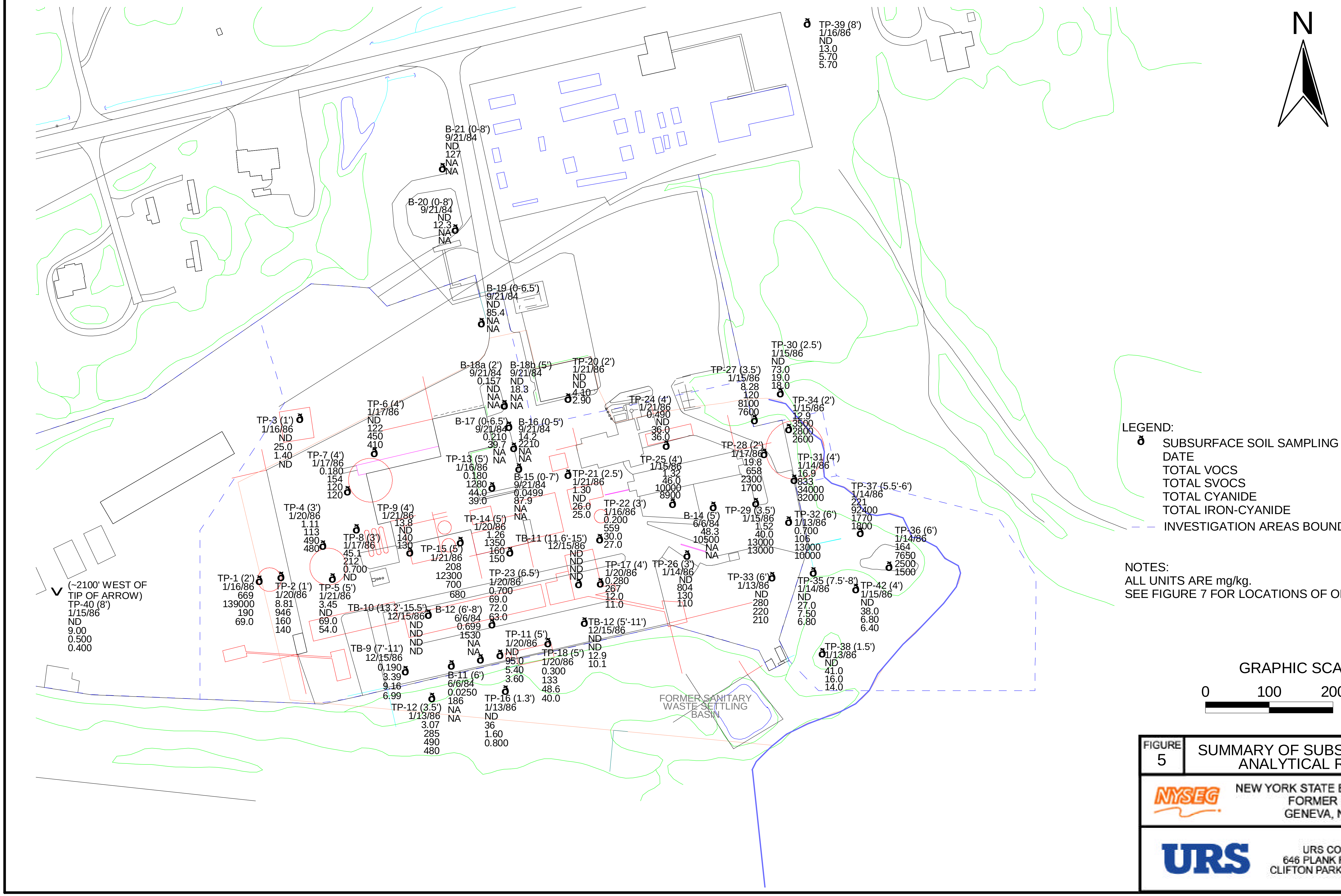
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065



LEGEND:

ð SUBSURFACE SOIL SAMPLING LOCATION
DATE
TOTAL VOCS
TOTAL SVOCS
TOTAL CYANIDE
TOTAL IRON-CYANIDE

--- INVESTIGATION AREAS BOUNDARY

NOTES:
ALL UNITS ARE mg/kg.
SEE FIGURE 7 FOR LOCATIONS OF OFF-SITE SAMPLES.

FIGURE
5

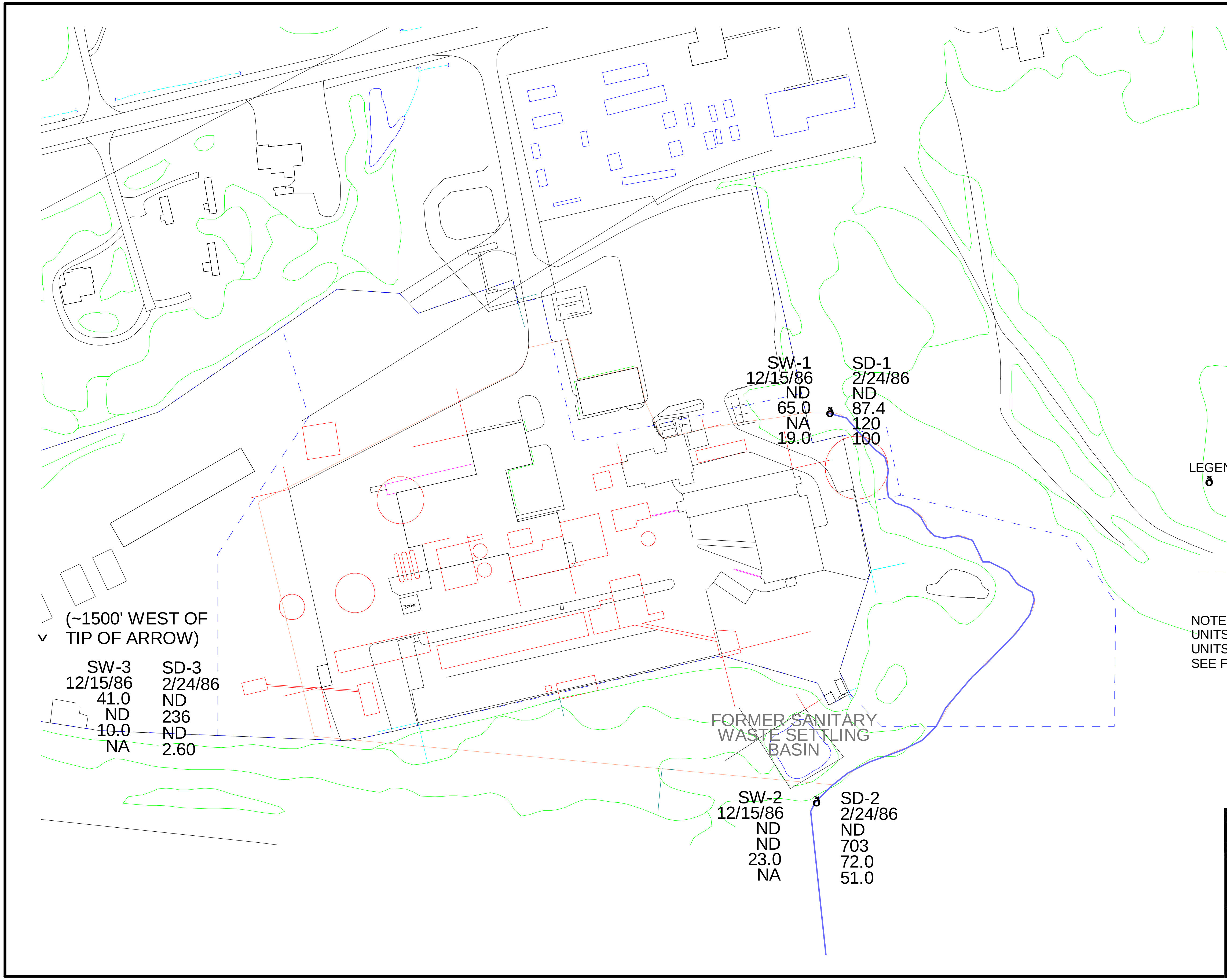
SUMMARY OF SUBSURFACE SOIL
ANALYTICAL RESULTS

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065



LEGEND:

ð SURFACE WATER/SEDIMENT SAMPLING LOCATION
DATE
TOTAL VOCS
TOTAL SVOCS
TOTAL CYANIDE
TOTAL IRON-CYANIDE

- - INVESTIGATION AREAS BOUNDARY

NOTES:
UNITS ARE ug/L FOR SURFACE WATER SAMPLES.
UNITS ARE mg/kg FOR SEDIMENT SAMPLES.
SEE FIGURE 7 FOR LOCATIONS OF OFF-SITE SAMPLES.

FIGURE
6

SUMMARY OF SURFACE WATER
AND SEDIMENT ANALYTICAL RESULTS

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065

LEGEND:
S OFF-SITE SAMPLING LOCATION

GRAPHIC SCALE
0 600 1200 Feet

FIGURE
7

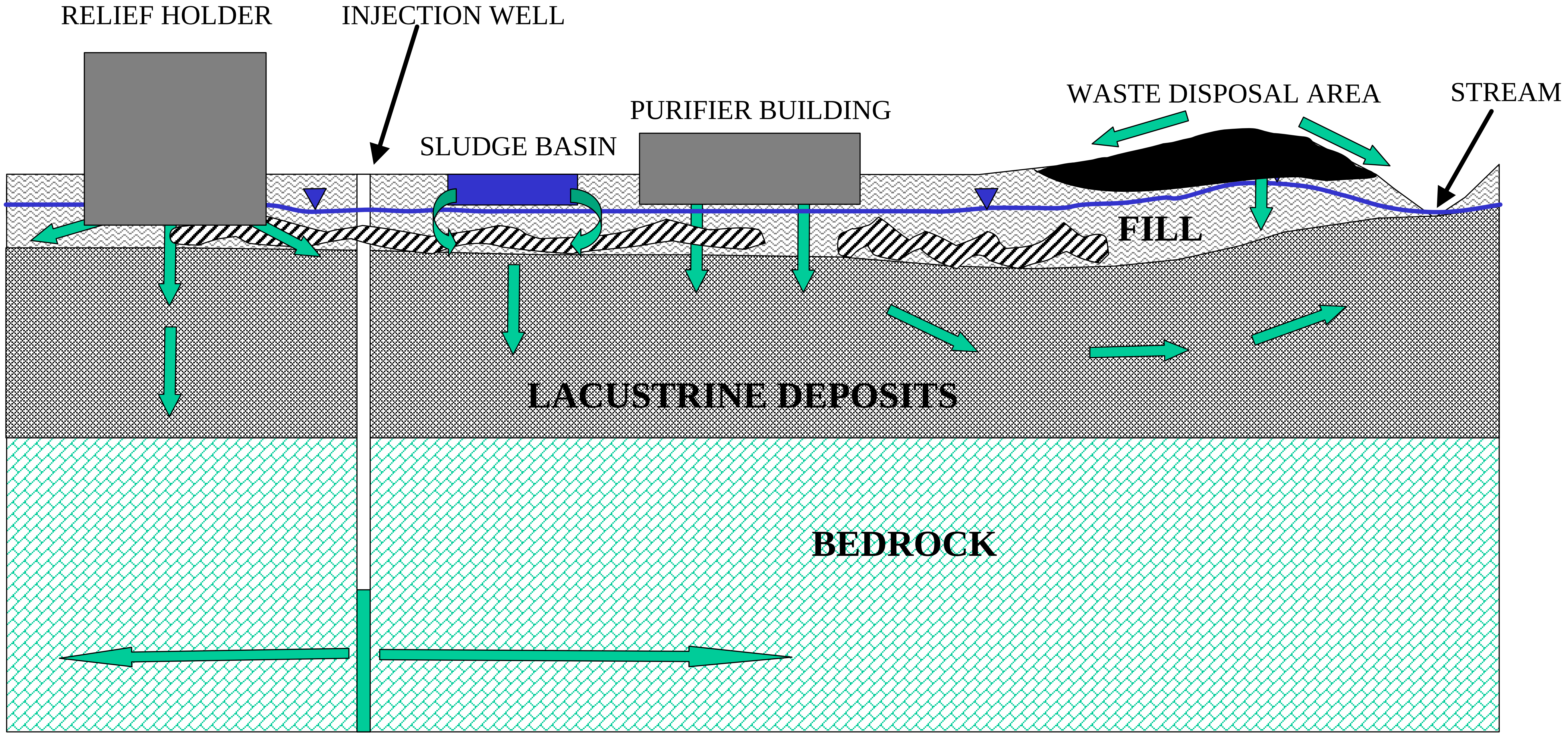
OFF-SITE SAMPLING LOCATIONS

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065



NOT TO SCALE

- Potential Migration Pathway
- Coal Tar
- Water Table

FIGURE 8

CONCEPTUAL SITE MODEL
FORMER MGP SITE
GENEVA-BORDER CITY

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065

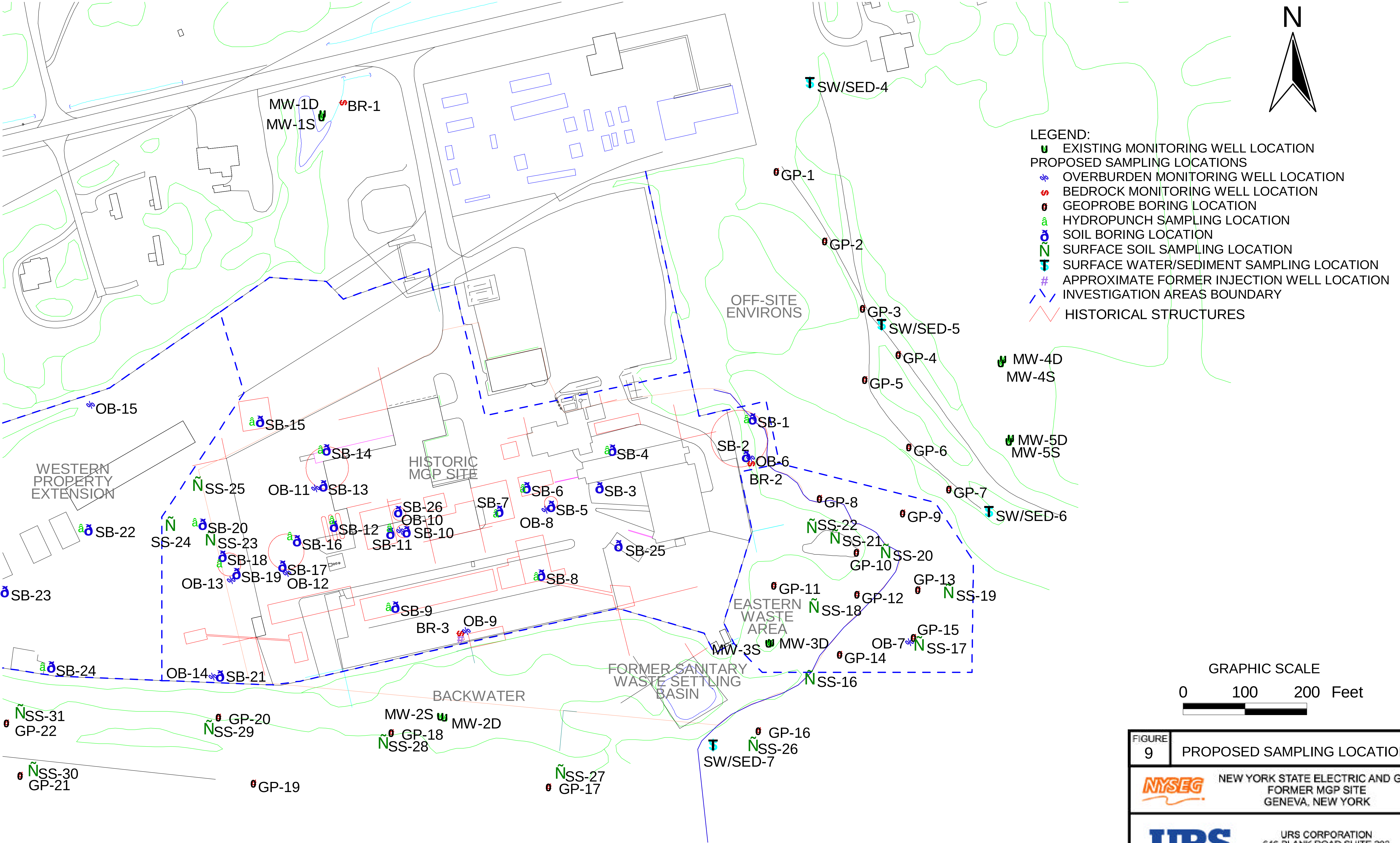


FIGURE
9

PROPOSED SAMPLING LOCATIONS

NYSEG

NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065

GRAPHIC SCALE
0 300 600 Feet

LEGEND:

S BEDROCK MONITORING WELL LOCATION

T SURFACE WATER/SEDIMENT SAMPLING LOCATION

FIGURE
10

PROPOSED OFF-SITE SAMPLING LOCATIONS

NYSEG

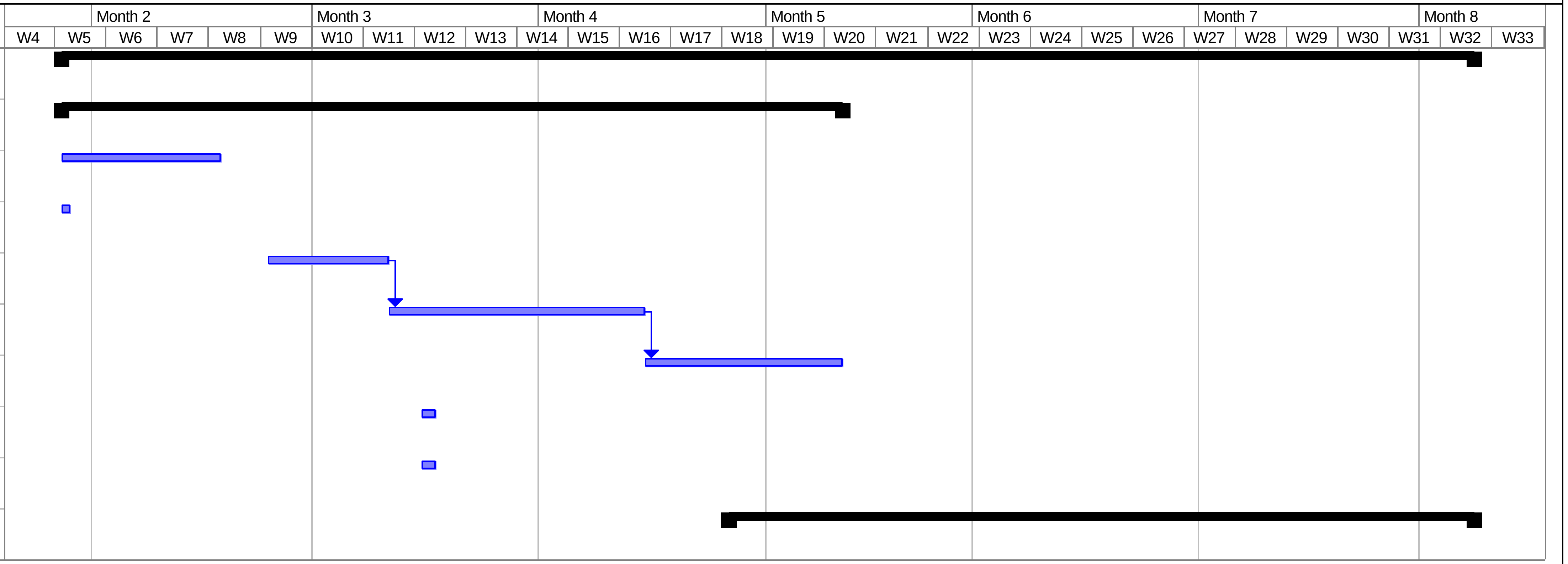
NEW YORK STATE ELECTRIC AND GAS
FORMER MGP SITE
GENEVA, NEW YORK

URS

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065

FIGURE 11
PROPOSED SCHEDULE
SUPPLEMENTAL REMEDIAL INVESTIGATION
NYSEG GENEVA-BORDER CITY FORMER MGP SITE

Task Name	Duration
Geneva-Border City Former MGP SRI	**138.75 days**
Field Investigation	**76.25 days**
Task 1 - Conduct Soil Borings and Hydropunch Sampling	2.5 wks
Task 2 - Oxide Box Sampling	1 day
Task 3a - Install/Develop Overburden Wells	2 wks
Task 5b - Install/Develop Bedrock Wells	4 wks
Task 6 - Groundwater Sampling	3 wks
Task 7 - Surface Water and Sediment Sampling	2 days
Task 8 - Surface Soil Sampling	2 days
Task 8 - Analyze Data and Prepare SRI Report	**73.75 days**



Revision No.: 0

QUALITY ASSURANCE PROJECT PLAN

for

New York State Electric and Gas
Former MGP Site Geneva - Border City

October 14, 2002

Prepared for:

NYSEG
Corporate Drive
Kirkwood Industrial Park
Binghamton, New York

Prepared by:

URS Corporation - New York
646 Plank Road, Suite 202
Clifton Park, NY 12065

A1 TITLE

QUALITY ASSURANCE PROJECT PLAN FOR NYSEG, GENEVA – BORDER CITY FORMER MGP SITE

A1.1 Organization

New York State Electric and Gas

A1.2 Responsible Officials

Name: Tracy Blazicek
Title: Project Manager, NYSEG
Phone: (607) 762-8839

Signature: ______________________ Date:________________

Name: Christopher Gaule
Title: Project Manager, URS Corporation
Phone: (518) 688-0015

Signature: ______________________ Date:________________

Name: Douglas MacNeil
Title: Project Manager, NYSDEC
Phone: _______________

Signature: _______________________ Date:________________

Name: _______________
Title: Laboratory Manager, Severn Trent Labs
Phone: _______________

Signature: ______________________ Date:________________

Name: Jennifer Gillies
Title: Quality Assurance Officer, URS Corporation
Phone: (518) 688-0015

Signature: ______________________ Date:________________

A2 TABLE OF CONTENTS

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Clifton Park, New York 12065

Jennifer Gillies
URS Corporation – New York
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Clifton Park, New York 12065

Chris McMahon
URS Corporation – New York
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STL Laboratory Manager
Severn Trent Services
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Shelton, CT 06484

URS Project File
URS Corporation – New York
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Clifton Park, New York 12065

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 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. Tracy Blazicek.

A4.1.2 URS Project Manager

The URS (URS) Project Manager, Christopher Gaule, 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, Chris McMahon 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 Severn Trent Laboratories (STL) QA Manager 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), Jennifer Gillies, 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 is 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 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 broadly 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 3 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.

Nonetheless, in general terms, 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 are documented rigorously with detailed QA/QC information provided in addition to detailed sample specific information, allowing for independent review. Soil, sediment, sludge, 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.

$$Accuracy = \left(\frac{MeasuredValue}{KnownValue} \right) \times 100\%$$

Equation 1

The accuracy objectives are noted in Table A7-1. 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

$$\%RSD = \left(\frac{s_{x_1 \ldots x_n}}{\overline{X}_{x_1 \ldots x_n}} \right) \times 100\%$$

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.

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

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 resampling 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 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 a predetermined comparison criteria, at specified levels of precision and accuracy. General reporting limits, which are highly matrix dependent, are presented in Table 2. Specific detection limits are presented in the method SOPs and/or laboratory QA manual.

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 log book as proof of said review.

To ease data review, the person making an entry must sign and date the entry. All entries must be recorded in ink or other permanent marking device. 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 is 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 samples have been received by the laboratory, 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.

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
- 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

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

Screening Data

Summary reporting only will be provided.

- Narrative and sample cross reference
- Copies of Chain of Custody documents
- Analytical results
- QA/QC summary

An example of an acceptable QA/QC summary is presented below.

QA/QC SUMMARY
Batch ID:
Matrix: Fraction:
Related Samples:

Parameter	Passed	Failed	Note
Holding time			
Surrogates			
Matrix spike			
Spike duplicate			
Blanks			
Calibration			
Check Sample			

Narrative Notes:

A9.4 Record Storage and Handling:

All records will be designated as "lifetime" or "nonpermanent" before temporary or final storage. Nonpermanent records will be retained for three years after the completion of the field work, 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 shipment to the 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 Severn Trent Laboratories, Inc. located in Shelton, Connecticut. The facility is more fully described in Attachment B.

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Field personnel will, at all times, be aware 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 to be documented in the form of a telephone conversation log entry.

B3.3 Sample Holding Times

Sample holding time, (the time between sampling 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 4. 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 4 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. 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 Section A10 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.

Disposable labware 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 labware 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/splits are collected and homogenized before being split. Field duplicates for water samples will be collected simultaneously. Samples submitted for VOC analyses are not homogenized or split. 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 team during sampling and will accompany the samples to the laboratory for volatile organic compound analysis. When low level VOCs analyses are being performed, an associated low level trip blank will be created. One trip blank will be submitted per day of sampling.

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

B5.2 Laboratory QC Samples

Table 5 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 his 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 5.

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 Section A10 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 are 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 by 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, ASCI 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 National Functional Guidelines (NFGs) 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. The protocols are applied such that the specifications of the method take precedence over the specifications of the NFGs in those instances where the specifications differ. A checklist based on the method/protocol is filled out by an independent reviewer. This checklist documents the checks performed and 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 complies 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 first round 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

URS Quality Assurance Manual, 2000

Data Quality Objectives Process for Superfund, Interim Final Guidance, EPA 540-R-93-071, September 1993.

EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R5, Final, February 1998.

Guidance for Data Quality Assessment, EPA QA/G-9, July 1996.

Guidance for Data Usability in Risk Assessment, Final, April 1992.

Methods for the Chemical Analysis of Water and Wastes, USEPA 600/4-79-20, March 1993.

Methods for Organic Analysis of Municipal and Industrial Wastewater, USEPA 600/4-82-057, July 1982.

Standard methods for the Examination of Water and Wastewater, 18th Edition, APHA, 1992.

Test Methods for Evaluating Solid Waste, USEPA SW-846, 3rd Edition, Update III, July 1997.

USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94/012, February 1994.

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA-540/R-94/012, February 1994.

TABLE 1
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

Analytical Method[1]	Matrix[2]	No. of Field Samples	Field Duplicates[3]	Equipment Blanks[3]	Trip Blanks[4]	MS/MSD (Pairs)[3]	Total No. of Samples
Task 1: Soil Boring Investigation							
BTEX	Soil/GW	46/17	3/1	0/1	0/5	3/1	55/26
PAHs	Soil/GW	46/17	3/1	0/1	0/0	3/1	55/21
PCBs	Soil/GW	46/0	3/0	0/0	0/0	3/0	55/0
Total Phenols	Soil/GW	46/17	3/1	0/1	0/0	3/1	55/21
Metals	Soil/GW	46/17	3/1	0/1	0/0	3/1	55/21
Total Organic Carbon	Soil/GW	23/0	3/0	3/0	3/0	3/0	35/0
Total Cyanides	Soil/GW	46/17	3/1	0/1	0/0	3/1	55/21
Task 2: Oxide Box Samples							
Total Cyanides	Solid/Water	1/1	0/0	0/0	0/0	0/0	1/1
PAHs	Solid/Water	1/1	0/0	0/0	0/0	0/0	1/1
Metals	Solid/Water	1/1	0/0	0/0	0/0	0/0	1/1
Reactivity	Solid/Water	1/1	0/0	0/0	0/0	0/0	1/1
Task 3: Groundwater Samples							
BTEX	GW	7	1	0	3	0	11
VOCs	GW	7	1	0	2	1	12
PAHs	GW	7	1	0	0	0	8
SVOCs	GW	7	1	0	0	1	10
PCBs	GW	14	1	0	0	1	17
Total Phenols	GW	14	1	0	0	1	17
Metals	GW	14	1	0	0	1	17
Total Cyanide	GW	14	1	0	0	1	17
Alkalinity	GW	5	0	0		0	5
Chloride	GW	5	0	0	0	0	5
Nitrate/Nitrite	GW	5	0	0	0	0	5
Sulfate/Sulfide	GW	5	0	0	0	0	5
Dissolved Iron	GW	5	0	0	0	0	5
Total Organic Carbon	GW	5	0	0	0	0	5
Task 5: Surface Water/Sediment Samples							
BTEX	Sed/SW	34/0	3/0	3/0	0/0	3/0	43/0
PAHs	Sed/SW	34/15	3/1	3/1	0/0	3/1	43/19

TABLE 1
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

Analytical Method[1]	Matrix[2]	No. of Field Samples	Field Duplicates[3]	Equipment Blanks[3]	Trip Blanks[4]	MS/MSD (Pairs)[3]	Total No. of Samples
PCBs	Sed/SW	34/15	3/1	3/1	0/0	3/1	43/19
Total Phenols	Sed/SW	34/15	3/1	3/1	0/0	3/1	43/19
Metals	Sed/SW	34/15	3/1	3/1	0/0	3/1	43/19
Total Cyanides	Sed/SW	34/15	3/1	3/1	0/0	3/1	43/19
Total Organic Carbon	Sed/SW	34/15	3/1	3/1	0/0	3/1	43/19
Task 6: Surface Soil Samples							
PAHs	Soil	19	1	1	0	1	23
PCBs	Soil	19	1	1	0	1	23
Total Phenols	Soil	19	1	1	0	1	23
Metals	Soil	19	1	1	0	1	23
Total Cyanides	Soil	19	1	1	0	1	23

1. Analyses include:
   BTEX - Benzene, toluene, ethylbenzene, and xylenes using USEPA SW-846 Method 8260B
   PAHs - Polyaromatic hydrocarbons using USEPA SW-846 Method 8270C
   VOCs - Target compound list volatile organic compounds using USEPA SW-846 Method 8260B
   SVOCs - Target compound list base/neutral/acid extractable semi-volatile organic compounds using USEPA SW-846 Method 8270C
   PCBs - Polychlorinated biphenyls using USEPA SW-846 Method 8082
   Total Phenols using USEPA SW-846 Methods 9065/420.1
   Metals - Al, Sb, As, Ba, Cd, Cr, Cu, Fe, Pb, Ni, Mn, Hg, Se, Ag, Vn, and Zn using USEPA SW-846 Methods 6010 and 7471
   Total Cyanide using USEPA SW-846 Method 9012 and SM 4500I
   Alkalinity using USEPA SW-846 Method 310.1
   Chloride using USEPA SW-846 Method 9250
   Nitrate/Nitrite using USEPA SW-846 Method 9200
   Sulfate/Sulfide using USEPA SW-846 EPA Method 9035
   Dissolved Iron (Field Filtered) using USEPA SW-846 Method 6010
   Total Organic Carbon using Lloyd-Kahn Method
   AVS-SEM - Acid Volatile Sulfide/Simultaneously Extracted Metals using USEPA SW-846 6010
2. GW - groundwater, Sed - sediment, SW - surface water
3. Assumes a 5% frequency (one per 20 field samples)
4. Approximate - Assumes one per day of field sampling for water samples only.

TABLE 2
QUALITY CONTROL CRITERIA FOR MEASUREMENT DATA

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

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	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]
AVS/SEM	RPD < 35%	70% < %R < 130%	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%	
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 B4-1. 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 (AttachmentB).
(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 - GENEVA-BORDER CITY
FORMER MGP FACILITY

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 ^{o}C	Analyze within 14 days.
BTEX (EPA Method 8260B)	4 oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze within 14 days.
SVOCs (EPA Method 8270C)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Extract within 14 days; analyze within 40 days.
PAHs (EPA Method 8270C)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Extract within 14 days; analyze within 40 days.
PCBs (EPA Method 8082)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Extract within 14 days; analyze within 40 days
Metals (EPA Method 6010/7470)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze within 6 months.
Acid Volatile Sulfide/Simultaneously Exractable Metals (EPA Method 6010)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze for most metals within six months. Sulfide analyze within 7 days.
Cyanide Total, Amenable (EPA 9012/335.3)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze within 14 days.
Weak and Dissociable Cyanide	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze within 14 days.
Total Phenols (EPA Method 9065/420.1)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze within 28 days.
TOC, Dissolved (EPA 415.2)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze within 28 days.
BTU (ASTM D240)	1-6oz. Glass jar, Teflon cap	Cool 4 ^{o}C	Analyze within 28 days.
Ignitability (EPA 1010)	All of these parameters can be done on the same sample in one 32oz. Plastic container	Cool 4 ^{o}C	Analyze immediately.
Corrosivity (SM16 203)			
Reactivity (SM 7.3.2.1.)			
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 ^{o}C	Extract within seven days; analyze within 40 days
PAHs (EPA Method 8270	1 Liter Glass	Cool 4 ^{o}C	Extract within seven days; analyze within 40 days

TABLE 3
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

NYSEG - GENEVA-BORDER CITY FORMER MGP FACILITY

Test Type	Container	Preservation	Holding time
PCBs (EPA Method 8082)	1 Liter Glass	Cool 4 °C	Extract within 14 days; analyze within 40 days
Metals (EPA Method 6010/7470)	32 oz., Plastic	HNO_3 to pH < 2	Analyze within 6 months.
Total Phenols (EPA Method 9065/420.1)	500 ml, Glass	H_2SO_4 to pH < 2	Analyze within 28 days.
Total Cyanide (EPA 9012/335.3)	8 oz., Plastic	NaOH to pH > 12 0.6g ascorbic acid	Analyze within 28 days.
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_2SO_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.
Ethane, Ethene, Methane (GC)	40 ml (2 per sample), Glass	Cool 4 °C	Analyze within 7 days.

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
METHODS OF ANALYSIS

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

Test Type	Sample Preparation/Analysis Method
Field Measurements	
Field pH	Per the FSP
Field temperature	Per the FSP
Field conductivity	Per the FSP
Laboratory Measurements	
BTEX/TCL VOCs, soils	SW-846 Method 5030A/8260B
BTEX/TCL VOCs, water	SW-846 Method 5030BA/8260B
PAHs/TCL SVOCs, soils	SW-846 Method 3550B/8270C
PAHs/TCL SVOCs, water	SW-846 Method 3550BA/8270C
PCBs, soils	SW-846 Method 5350B/8082
Mercury, soils	SW-846 Method 7471A
Mercury, water	SW-846 Method 7470A
Other Metals, soils	SW-846 Method 3050B/6010B
Other Metals, water	SW-846 Method 3010A/6010B
Total Phenol, soil & water	SW-846 Method 9065/E420.1
Cyanide, soil & water	SW-846 Method 9010A/9012A;/E335.3; SM4500I
TOC, soil & water	SW-846 Method 9060
AVS/SEM, soil	SW-846 Method 6010

TABLE 5
QUALITY CONTROL SPECIFICATION FOR ANALYSIS

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

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	± 10 %D from initial[2]	new initial calibration, repeat tests
Calibration Blank3	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	±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 ± 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	< RL6	maintenance, repeat tests

TABLE 5
QUALITY CONTROL SPECIFICATION FOR ANALYSIS

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

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 ± 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	± 10 %D from initial[2]	new initial calibration, repeat tests
Calibration Blank3	every 10 samples and end of run	< RL[6]	maintenance, repeat tests
Calibration Verification	after initial calibration	±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 - ±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.

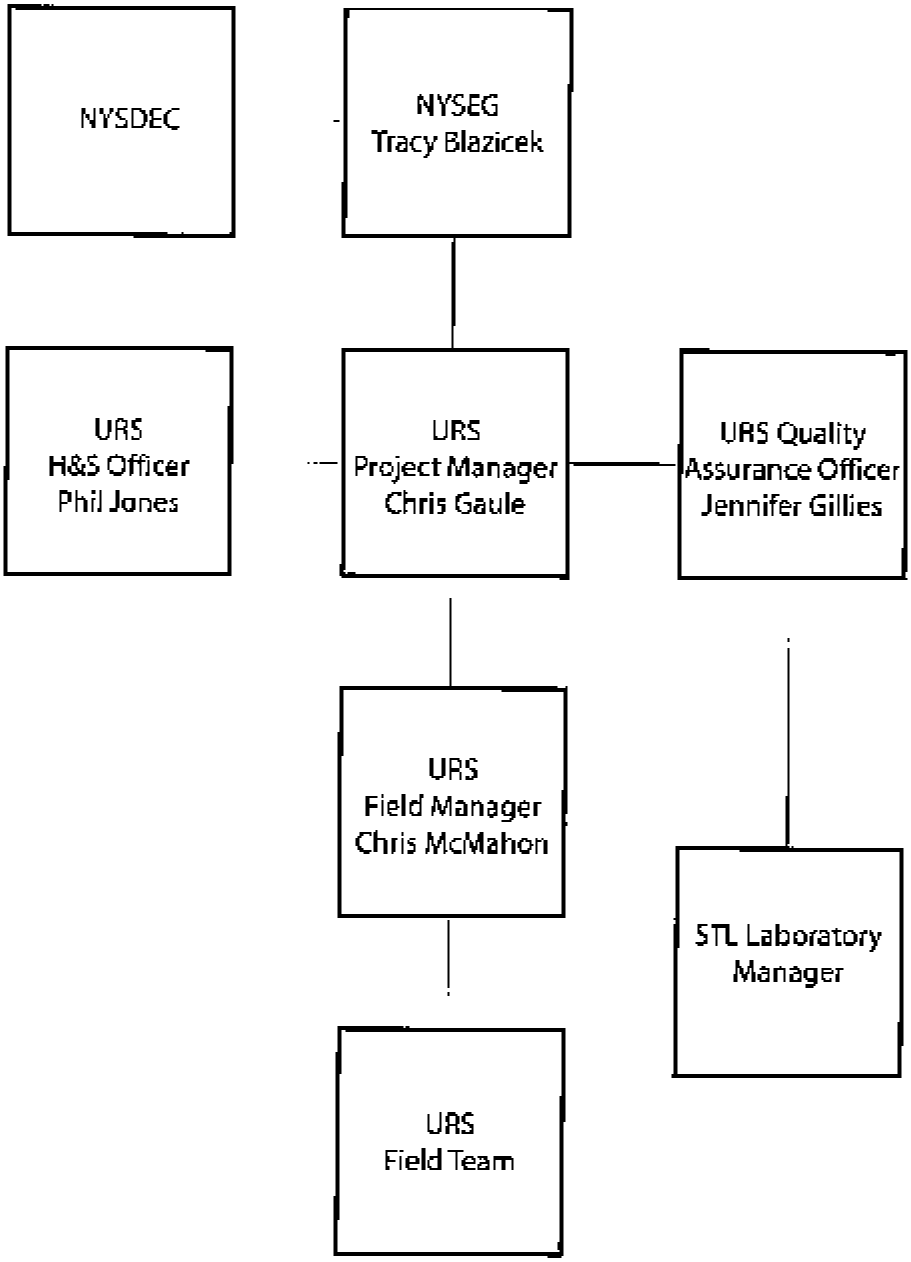

FIGURE 1

ORGANIZATIONAL CHART

NYSEG

NEW YORK STATE ELECTRIC AND GAS
GAS DISPATCH CENTER
ALBION, NEW YORK

URS CORPORATION
646 PLANK ROAD SUITE 202
CLIFTON PARK, NEW YORK 12065

CHAIN-OF-CUSTODY RECORD

WHITE COPY-Original (Accompanies Samples) YELLOW COPY-Collector PINK COPY-Project Manager

SAMPLE ID	DATE	TIME	SAMPLE MATRIX	SAMPLE BOTTLE SIZE/TYPE/PRES. G=GLASS P=PLASTIC	Total Number of Bottles	Analysis Required							COMMENTS:	Laboratory ID

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)

ANALYTICAL LABORATORY: ______

LABORATORY CONTACT: ______

D&M CONTACT: ______ PHONE: ______

JOB NO.: ______

PROJECT: ______

LOCATION: ______

COLLECTOR: ______ DATE OF COLLECTION ______

URS

646 Plank Road, Suite 202
Clifton Park, NY 12065
(518) 688-0015 Fax (518) 688-0022

Figure C1-1
Corrective Action Report Form

CORRECTIVE ACTION REPORT

Number CAR-______ Date ______

RECOMMENDATION

To ______

You are hereby requested to implement the actions indicated below and as otherwise determined by you (A) to improve the noted condition and (B) to monitor the improvements. Your written response is to be returned to the QAO by ______________________.

Subject:

Reference Documents:

Recommended Action:

Originator	Date	Approval	Date	Approval	Date

RESPONSE

Evaluation:

Action:

Monitoring Steps:

Affected Documents:

Signature	Date	QA Follow-up on Corrective Action:	Verified	Date

HEALTH AND SAFETY PLAN
NYSEG
FORMER MANUFACTURED GAS PLANT
GENEVA, NEW YORK

Job No.: 38393613.00000
Prepared by: Scott M. Hulseapple
Date: October 24, 2002

HEALTH AND SAFETY PLAN
NYSEG
FORMER MANUFACTURED GAS PLANT
GENEVA, NEW YORK

		PHONE/CELL
Project Number:	38393613.00000	
Project Manager:	Mr. Christopher Gaule	(518) 688-0015/(518) 210-8024
Site Manager:	Mr. Chris McMahon	(518) 688-0015
Site Safety Officer:	Mr. Chris McMahon	(518) 688-0015
Plan Preparer:	Mr. Scott Hulseapple	(518) 688-0015
Preparation Date:	December 19, 2003	
Expiration Date:	December 19, 2003	

APPROVALS

Health and Safety Representative:

____
(DATE)

Regional Health and Safety Manager:

____
CIH/CSP (DATE)

Project Manager:

____
(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
GENEVA, NEW YORK

TABLE OF CONTENTS

ATTACHMENTS

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
GENEVA, 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 -

Project Manager:	Christopher Gaule	(518) 688-0015
Health and Safety Representative:	John Hawley	(518) 688-0015
Regional Health and Safety Manager:	Phil Jones	(215) 542-3800
Alternates		

National Response Center (800) 424-8802

HOSPITAL DIRECTIONS:

Geneva General Hospital
196 North Street
Geneva, New York
(315) 787-4063

To reach the hospital from the site, turn left (west) onto County Road 110 (Border City Road) for approximately 0.5 miles. Stay on CR-110, which changes to West North Street at the intersection of NYS-Route 14, for approximately 1.5 miles. Geneva General Hospital will be on the right.

Additional information concerning emergency procedures is located in Section 11.0 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. 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/Well Installations	med	med	med	med	low	med	n/a	n/a	n/a
2. Groundwater Sampling	med	med	n/a	low	low	low	n/a	n/a	n/a
3. Surface Water and Sediment Sampling	low	med	n/a	low	low	low	n/a	n/a	n/a
4. Test Pit	low	med	med	med	low	med	n/a	n/a	med
5. Oxide Box Sampling	med	low	n/a	low	med	low	n/a	n/a	n/a

High - Exposure likely more than 50% of the time
Med - Exposure likely 10-50% of the time
Low - Exposure likely less than 10% 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, poly-coated Tyvek, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.
3	Steel-toed boots or hip waders, hard hat, safety glasses, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.
4	Steel-toed boots.
5	Steel-toed boots, hard hat, safety glasses, 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 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 HSP 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 4) 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
- 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
X OVM PID w/ 11.7 eV lamp
__ Photovac Microtip PID w/ __ eV lamp
__ MiniRAE PID w/ ___ eV lamp
X Combustible Gas/O_2 Indicator
__ Foxboro OVA (FID)
X Miniram Real-time Dust Monitor
__ Other __________________

For more information, see Section 6.0

PERSONAL EXPOSURE SAMPLING

X Will be conducted
X Will be conducted if PID readings require the use of respiratory protection as described in the Action Level Table (page 4) 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 **(1st 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 **(2nd Action Level)**	OBZ	> 1 minute	Monitor OBZ, provide respiratory protection.	Add half-face respirators with organic vapor cartridges
>50 ppm **(3rd 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 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	
3		URS Safety Management Standards (relevant to project - see next page)
3		OSHA “Safety on the Job” Posters
3		Hardhats
3		Safety glasses
3		Ear plugs or muffs
	3	Cotton coveralls
	3	Traffic safety vest
3		Tyvek® coveralls
	3	Polycoated Tyvek® Q-23 Coveralls
3		Steel-toed boots
3		Chemical-resistant steel-toed boots or chemical-resistant boot covers
	3	Work gloves
3		Nitrile outer gloves
3		Surgical nitrile inner gloves
3		Plastic sheeting (visqueen)
	3	55 gallon 17-H drums (for contaminated solids)
	3	55 gallon 17-E drums (for liquids)
	3	Drum liners
	3	Barricade tape and barricades
	3	Wash tubs and scrub brushes
3		Decon solution (i.e., TSP)
	3	Folding chairs
	3	5 or 10 gallon portable eyewash
	3	Respirator sanitizing equipment
3		First Aid kit
3		Infection control kit
3		Drinking water
3		Gatorade or similar drink
3		Type ABC fire extinguishers
3		Half-face respirators (NIOSH approved)
	3	Full-face respirators (NIOSH approved)
3		Respirator cartridges **[organic vapor]**
3		Photoionization Detector (PID) w/[**11.7**] lamp and calibration kit
	3	Combustible Gas Indicator and calibration kit
	3	Garden sprayer
	3	Compressed gas horn
3		Duct tape
3		Paper towels and hand soap
	3	Spill sorbent
3		Plastic garbage bags
	3	Broom and/or shovel

SAFETY MANAGEMENT STANDARDS REFERENCED BY THIS HSP

SMS	TOPIC	HSP SECTION
45	Back Injury Prevention	5.2.5
9	Corrosive Material (Sample Preservation)	
56	Drilling	5.2
12	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
19	Heavy Equipment Operations	5.2.6
49	Incident Reporting	12.6
43	I.H. Monitoring	6.1.1
26	Noise and Hearing Conservation	5.2.3
47	Outdoor Environments	5.2.11
29	Personal Protective Equipment	7.0
42	Respiratory Protection	8.3/8.9
30	Sanitation	10.1
46	Subcontractors	4.0
32	Traffic Control	5.2.8
34	Utility Clearances	5.2.7
2	Worker Right to Know	5.1.2

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 HISTORY

The site is located in Border City, Seneca County, in the Finger Lake Region of New York State near the north end of Seneca Lake, two miles east of the City of Geneva. The site is approximately 1,500 feet north of the north shore of Seneca Lake. Between the site and Seneca Lake is Seneca Lake State Park and New York State Route 5 and US Route 20. Currently there are approximately eight buildings onsite, several of which were previously used in the gas manufacturing process while the facility was in operation

The Empire Coke Company constructed the original MGP plant at the site between 1901 and 1903. The original plant consisted of 31 coke ovens and two gas holders. The plant produced gas as a by-product of the coking operation. In 1909, the facility was expanded to allow the production of blue gas. The 1909 expansion included a 100,000 cubic foot holder associated with the Blue Gas operation and fourteen additional coke ovens, bringing the total number of ovens to 46. In 1914, the plant was sold to Empire Gas and Electric Company. In 1925, New York Central Electric Corporation purchased Empire Gas and Electric Company. NYSEG has owned the property since 1932.

2.2 PURPOSE AND SCOPE OF WORK

The field activities presented in the *SRI Work Plan* are briefly discussed below.

INSTALL ADDITIONAL SOIL BORINGS AND MONITORING WELLS

The drilling program of the *SRI* will be completed in an iterative fashion, thus allowing adjustments to the placement of the subsequent investigative locations, if required, based on the observations from the preceding locations. The iterative aspect of the SRI drilling program will also provide opportunity to add or eliminate drilling locations, as warranted, based on field observations. The decisions to adjust location and add or eliminate drilling locations, will be made in the field (whenever possible), and agreement between NYSEG and the NYSDEC will be reached before proceeding.

URS will advance soil borings using both GeoProbe and standard drill rigs. Furthermore, URS will install both overburden and bedrock monitoring wells. The overburden wells will be installed using hollow-stem augers. The bedrock monitoring wells will be installed using steel drive and wash casing and reverse rotary drilling methods.

FURTHER EVALUATE GROUNDWATER QUALITY

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. Groundwater samples will be collected from each well using standard purge and sample methods. The water samples will be analyzed for the analytical parameters considered to be indicators of the potential MGP-related impacts.

FURTHER EVALUATE SURFACE WATER SEDIMENT QUALITY

During the SRI, URS will conduct a reconnaissance of the two on-site streams, along the site and downstream to the confluence with the Seneca Lake to evaluate the current conditions in the two on-site streams. Sediment samples and surface water samples will be collected as described in the SRI workplan.

TEST PIT INVESTIGATION

URS will conduct a geophysical investigation to locate the former on-site injection well. Following the geophysical investigation, a test trench will be excavated to confirm the location of the former well head.

OXIDE BOX SAMPLES

URS will collect samples of the solids and liquids in the former oxide purifier beds. The beds are located below the first floor of the former purifier house. The samples will be collected through access panels in the floor. No URS personnel will enter the area beneath the first floor for any reason.

3.0 APPLICABILITY

The purpose of this plan, which was developed specifically for operations at the **NYSEG Former Manufactured Gas Plant** site, **in Geneva-Border City, 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 log book; 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 even 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 4) 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. STELs are used by OSHA, ACGIH and NIOSH for chemical exposure criteria.

A ceiling value (C) is a concentration that should not be exceeded at any time in any workday. Ceiling limits are used by OSHA, ACGIH and NIOSH for chemical exposure criteria.

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	Dermatitis, Bronchitis Potential Carcinogen
Benzene	1 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eye & Central Nervous System Depressant	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	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	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	Inhalation, skin, ingestion	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.

Inhalation of vapors or particulates during the site activities will be minimized by air monitoring and the use of engineering controls, 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) 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:

Power Lines Nominal System (kv)	Minimum Required Clearance
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 it has been inspected by a competent person in accordance with 29 CFR 1926.650-651. If personnel are required to enter a trench or excavation that is deeper than ***four*** feet, the following provisions must be provided prior to entry by the contractor who created the excavation:

- If hazardous atmospheres are suspected, any trench or excavation more than four feet deep must be monitored.
- Adequate shoring, sloping, 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 the two small on-site streams. 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.

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 ($\geq$ 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 half-face respirators with appropriate cartridges. An OBZ reading above the third Action Level ($\geq$ 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 chemical ***exposure*** in accordance with National Institutes for Occupational Safety and Health (NIOSH). 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, 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 (half-face or full-face as appropriate for analyzer readings) with combination organic vapor-HEPA 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. Half-face respirators with HEPA cartridges should 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/O_2 (CGI/O_2) meter will be used to monitor ambient conditions. Decisions will be based on the levels measured using a CGI/O_2 meter (measurements are in % of the Lower Explosive Limit) as determined by the Action Level Table located on **page 4.**

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:

20.8%	Continue Operations
<20.8%	Continuous Monitoring
<19.5%	Do not enter, ventilate and determine if supplied air equipment is required

7.0 PERSONAL PROTECTIVE EQUIPMENT

The minimum Personal Protective Equipment (PPE) for site personnel includes:

- Hardhat
- Safety glasses with side shields (or impact resistant goggles)
- Steel-toed boots or (Neoprene) Chemical-resistant steel-toed boots
- Ear protection in vicinity of noisy equipment
- Work gloves and/or chemical-resistant gloves
- Tyvek coveralls 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 use. 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 HSP 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.*

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 110EF). A stiff bristle (not wire) brush may be used.
Rinsing:	Rinse in clean water (110EF 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 (110EF 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, nosecups 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 <u>must</u> be shipped in accordance with those regulations by an individual who is certified as having been Function-Specific trained as required under the DOT 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:

Signal	Definition
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 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 (***Phil Jones at 215-542-3800***). 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	Philip Jones	215-542-3800
Health and Safety Representative	John Hawley	518-688-0015
Project Manager	Christopher Gaule	518-688-0015

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

Print this page using the print function in your browser.

Directions	Distance	Time
Start: Depart Border City Rd, Geneva, NY, 14456 on **Local road(s)** (North)	0.1	0:01
1: Turn **LEFT** (West) onto **CR-110 [Border City Rd]**	0.5	0:02
2: Continue (West) on **(E) North St**	1.3	0:05
3: Continue (West) on **North St [W North St]**	0.1	< 1min
End: Arrive 196 North St, Geneva, NY, 14456	< 0.1	< 1min
Total Route	**2.0 mi**	**8 mins**

Expedia.com
Don't just travel. Travel Right.

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

Inspections by Regulatory Agencies

1. Applicability

This program applies to URS office and field operations.

2. Purpose and Scope

Representatives of regulatory agencies may have statutory authority to evaluate URS operations for compliance with health and safety regulations. URS personnel are to cooperate with all such inspections. This procedure provides guidelines for responding to the inspector and for documenting inspection activities.

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. Obtaining Positive Identification

Request formal identification (photo identification card) from any regulatory agency representative. Call the agency if there is any question regarding the identity of the individual (independently obtain the agency's number; don't use a number provided by the representative). Obtain a business card from the inspector for URS records.

B. Warrants

Do not require an inspector to obtain a warrant prior to conducting an inspection.

C. Health and Safety Notification

Contact the local URS Health and Safety Representative or URS Health and Safety Manager immediately upon confirming the identification of the representative.

D. Opening Conference

1. Request an opening conference if one is not initiated by the inspector.

2. Use the opening conference to determine why the inspector is conducting the inspection.

3. Take good notes during the conference.

E. Inspection Activities

1. Escort the inspector at all times, taking him/her directly to the area of interest.

2. Answer all questions honestly, but do not volunteer information.

3. Do not argue with or attempt to mislead the inspector.

4. Resolve violative conditions immediately, while the representative is on site, if possible.

5. Make sure the inspector has appropriate qualifications to enter high hazard areas.

6. Take good notes during the inspection and take pictures where the inspector takes pictures.

7. Inspectors generally have the right to interview employees if they do not interrupt operations.

F. Closing Conference

1. Request a closing conference if one is not initiated by the inspector.

2. Use the closing conference to determine what regulatory violations the representative found, if any.

3. Do not try to negotiate during the closing conference.

4. Take good notes during the conference.

G. Post-Inspection Activities

1. Immediately contact URS Health and Safety Manager and communicate the results of the inspection. The URS Health and Safety Manager will provide additional instructions regarding the inspection.

2. Debrief any employees who were contacted by the representative; all discussions should be reduced to notes.

3. All follow-on activities associated with the inspection will be coordinated by the Group Health and Safety Manager and appropriate legal counsel. Local URS employees are not to conduct any follow-on activities without the express consent of the URS Health and Safety Representative.

5. Documentation Summary

Provide the following documents to the URS Health and Safety Manager:

A. Inspector's business card.

B. All materials provided by the inspector.

C. All notes relating to the inspection, opening conference, closing conference, and debriefings.

D. All photos from the inspection, with explanatory notes.

6. Resources

U.S. OSHA - Field Inspection Reference Manual

SMS 002
Issue Date 6/9/99
Revision 0

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.

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.

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.

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

SMS 003
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Revision 0

URS **SAFETY MANAGEMENT STANDARD**

Emergency Action Plans

1. Applicability

This procedure applies to URS office and field operations.

2. Purpose and Scope

This procedure establishes policy, assigns responsibilities, and provides guidance to URS offices/field projects regarding emergency action. It includes general information on actions to be taken by URS management and employees in the event of a fire or other emergency that may endanger life or property.

The objectives of this procedure are to:

A. Promote a fast, effective reaction in coping with emergencies.

B. Save lives and avoid injuries and panic.

C. Restore order and conditions back to normal levels with a minimum of confusion and as promptly as possible.

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. Emergency Action Plan Development

1. Gather Information

Each URS office/project must develop an emergency Action Plan tailored to its specific situation. Office Managers will check with their building manager or landlord regarding evacuation procedures they may have in place and incorporate these procedures into the emergency Action Plan. Project EAPs must comply with client requirements and specifications. The Plan must contain the following:

a. Reporting Fires and Other Emergencies

Describe the procedures that personnel should follow to report emergencies. List emergency telephone numbers for fire, paramedics and police. Include local prefixes on emergency numbers, if required, such as 9-911.

b. Alarm System

Describe the emergency alarm system for the building/site as applicable. Include the description and location of fire alarm pull boxes, and visual and audible alarms. If a public address (PA) system is used to notify occupants of emergencies, include the procedures to activate the PA system, such as calling the receptionist or building manager's office, and a description of the announcements that will be made.

c. Evacuation Routes and Procedures

Develop a map or description of the evacuation routes and emergency exits to be use. A description of the building emergency lighting system and exit signs may also be included. Evacuation route maps may be posted in the offices. There should be a primary and alternate evacuation route and exit from each work area.

Describe procedures regarding the use of elevators, if applicable. In most cases elevator use is prohibited during an emergency. The building manager should be consulted for these procedures.

Include procedures to determine that no employees have been inadvertently left behind.

d. Critical Equipment/Operations Procedures

Designate personnel responsible for shutting down critical equipment and the procedures for doing so, if applicable.

e. Assisting Disabled Personnel

Describe the provisions that have been made for notifying and assisting personnel with disabilities during an emergency. Such provisions are to accommodate personnel in wheelchairs or those who are temporarily disabled, such as personnel on crutches.

f. Personnel Accounting Procedures

Designate a primary and alternate assembly area for personnel who are evacuating. Require sufficient distance so that personnel will not be exposed to fire or debris hazards, or traffic, nor interfere with emergency responders.

Designate an individual and an alternate with the assigned responsibility for taking a headcount in the assembly area and reporting missing personnel to emergency responders.

Define the procedures on how employees will be informed that it is safe to re-enter the building or to leave for home.

g. Rescue and Medical Duties

Include the statement that "URS does not expect or encourage its employees to engage in firefighting, medical treatment, rescue, or other emergency response. Such activities should only be performed by properly equipped and trained emergency responders. URS recognizes that some of its personnel may have received training in first aid and cardiopulmonary resuscitation (CPR) and may wish to perform these duties on injured personnel."

B. Posting

1. Post the Emergency Action Plan where it is available to all employees.
2. Post evacuation maps at all exits and points of egress.

C. Training

Train all employees regarding the requirements of the Emergency Action Plan.

5. Documentation Summary

A. Office

File these records in the Office Safety Filing System:

1. Emergency Action Plan

   2. Evacuation Maps
   3. Training records

B. Field

File these records in the Project Safety File.

   1. Emergency Action Plan
   2. Evacuation Maps
   3. Training records

6. References

A. U.S. OSHA Standard - Emergency Action Plans - 29 CFR 1910.38

B. U.S. OSHA Fact Sheet - Responding to Workplace Emergencies

SMS 009
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Revision 0

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.

        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.

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.

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.

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

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.

   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.

        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.

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

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

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

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.

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

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

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.

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

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.

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

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

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

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.

    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 ¼ 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.

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.

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.

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

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.

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:

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.

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.

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

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

URS **SAFETY MANAGEMENT STANDARD**

Heat Stress

1. Applicability

This procedure applies to URS field projects where ambient (not adjusted) temperatures exceed 70^{o}F (21^{o}C) for personnel wearing chemical protective clothing, including Tyvek coveralls, and 90^{o}F (32^{o}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 (adjusted) = T (actual) + (13 x fraction sunshine)

C. Body Temperature Monitoring

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. Pulse Rate Monitoring

1. Take the radial pulse as early as possible in the rest period.

   a. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third.

   b. If the heart rate still exceeds 110 beats per minute at the next rest cycle, shorten the following work cycle by an additional one-third.

E. Record monitoring results on Heat Stress Monitoring Form (Attachment 18-2).

F. Investigate the use of auxiliary cooling devices in extreme heat conditions.

G. 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.

H. Provide water and electrolyte replacement drinks fluids as described in Attachment 18-3.

I. Allow employees who are not accustomed to working in hot environments appropriate time for acclimatization (see Attachment 18-3).

J. Provide break areas as described in Attachment 18-3.

5. Documentation Summary

File these records in the Project Safety File.

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"

The following documents are PDF Files that must be read with Adobe Reader.

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. Operators shall maintain three points of contact whenever entering and exiting a piece of equipment.
7. 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.

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.

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.

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

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

Lockout and Tagout Safety

1. Applicability

This procedure applies to URS projects involving exposure to uncontrolled sources of energy.

2. Purpose and Scope

This procedure outlines the requirements that must be followed to prevent injuries, either direct or indirect, when work is performed near or on an energy source that is unexpectedly operated.

Some energy sources that should be protected against include:

A. Electrical circuits.

B. Fluid systems (water and liquid product).

C. Pneumatic systems.

D. Flammable systems (including liquid and gaseous fuels).

E. Thermal systems (steam).

F. Gravity systems.

G. Hazardous material systems.

3. Implementation

Field Operations - Implementation of this Procedure is the responsibility of the Project Manager

4. Requirements

A. General

1. "Authorized employee" means a person who locks/tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment, and who has received the training described in Section C, below.

2. "Affected employee" means an employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout and

tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

3. "Qualified person" means person who is familiar with the construction and operation of the equipment and the hazards involved, and who:
    a. Requests de-energizing of an energy source.
    b. Inspects de-energizing with the authorized employee.
    c. Assures that authorized employee has locked and tagged the source.
    d. Requires that all applicable authorized employees affix lock/tags at the same locations(s).
    e. Operates the equipment controls or otherwise verifies that the equipment cannot be restarted after being locked out.
    f. Coordinates the continuation of lock/tagout protection through shift or personnel changes.
    g. Controls accountability of locks and tags.
    h. Makes appropriate log entries on Attachment 23-1.
    i. Conducts tests and visual inspections prior to reenergizing to check that circuits and equipment can be safely energized.
4. Employees shall not work on or in equipment, vessels, etc., which are **not** in a "zero energy state".
5. Coordinate all lockout and energy control activities with client, owner, contractor, and subcontractor practices and programs.
6. Require that all locks are keyed differently and that only one key exists for each lock and remains in the possession of the authorized employee to whom it has been assigned.

B. Procedure

Follow this lock and tagout procedure whenever the unexpected operation of equipment, switch, or valve or other energy sources could injure someone. Only authorized employees may perform jobs requiring lockout procedures.

1. **Step 1** - Achieving Zero Energy

    a. Identify and locate all sources of energy that could affect individuals involved.

    b. Notify all affected personnel that equipment is going to be de-energized and accessed. This can be done verbally, visually, or by hanging a warning tag on the control panel.

    c. Disconnect the main sources of power by breaking the primary power circuit, valve, pipe, etc. Locking out a low voltage control circuit is not considered breaking a main power source.

    d. Disconnect each separate power source of multiple power systems, e.g., air over hydraulic, electric over hydraulic, etc.

    e. Release all residual energy remaining behind the power source, e.g., hydraulic or air pressure, etc.

    f. Secure all power sources in the de-energized position with a lockout device. Use multiple lock devices when more than one lock is required. Each person who is protected by the lockout:

        1. Places a signed lock and tag on source location(s).

        2. Keeps the key to his/her own lock.

        3. Removes own lock (only exception: person not on site and person is contacted).

        4. Works ***only*** on protected source(s).

        5. Removes lock at completion for work shift or transfer.

    g. Block or blank any machinery, device, or piping system that can move on its own or deliver energy with or without the power source.

    h. Test equipment, prior to working on it, to insure that all sources of energy have been isolated and that it is "safe".

2. **Step 2** - Preparing to Re-Energize
    a. Once the task has been completed, tools picked up, safety chains, guards, guard rails, warning signs, etc. are replaced, notify affected personnel that the lockout device is going to be removed.
    b. Remove locks and tags.
    c. Once all lockout devices have been removed, the equipment or process may be restarted.
3. Temporary operation of locked out source
    a. Make sure everyone is clear of the system.
    b. Make sure tools are clear.
    c. Remove lock(s).
    d. Energize the system and conduct check.
    e. Immediately de-energize the system and replace locks.
4. Unauthorized removal of lock and tag is prohibited. Use the following procedure for Supervisor or Qualified Person to remove lock/tag when employee is not available:
    a. Verify authorized employee is not on site and available to remove own tag.
    b. Check that employees are not exposed to hazards.
    c. Verify equipment is safe to operate, tools have been removed and guards have been replaced.
    d. Remain with affected equipment so that no one returns while equipment or process is being restarted.
    e. Remove lock/tag and energize equipment.
    f. Require that affected employee knows the lockout device(s) has been removed before he/she resumes work.

C. Training

1. Authorized employees must receive training prior to conducting lockout/tagout activities.

2. Training must include:

    a. Purpose of lockout procedure.

    b. Hazards associated with different energy sources.

    c. Recognition of when to lockout.

    d. Electrical lockout procedures.

    e. Valve lockout procedures.

    f. Compliance with lockout procedures.

    g. Discussion of specific procedures.

5. Documentation Summary

File these records in the Project Safety File:

A. Training records for authorized employees

B. Lockout Log

6. Resources

A. ANSI 235.2

B. U.S. OSHA Standard - Accident Prevention Tags and Signs - 29 CFR 1926.200

C. U.S. OSHA Standard - Lockout and Tagging of Circuits - 29 CFR 1926.417

D. U.S. OSHA Technical Links - Lockout/Tagout

E. U.K. - 'Management of Health and Safety Work' Regulations

F. Attachment 23-1 - Lock and Tag Log

Medical Screening & Surveillance

1. Applicability

This program applies to employees assigned to work environments where there is a potential for exposure to chemical, biological, and/or physical hazards. Individuals will be selected for medical screening based on regulatory standards, project health and safety plan assessments, the expected use of personal protective equipment, and client contract requirements.

2. Purpose and Scope

The overall goal of this program is to prevent occupational illness and injury by early identification of exposure-related health effects before they result in disease. Medical examinations will be performed in order to determine if employees are capable of safely performing assigned tasks, to verify protective equipment and controls are effectively providing protection, and to comply with governmental regulations. Included are provisions for emergency medical consultation and treatment.

3. Implementation

Office/laboratory locations – Implementation is the responsibility of the Office Manager.

Field activities – Implementation is the responsibility of the Project Manager.

Program Administration – The Occupational Health Specialist (OHS) is responsible for development and administration of this program in coordination with the URS Medical Service Provider (MSP). The OHS will maintain current injury and illness data and participate with Corporate Health & Safety Managers in evaluation of this program. The MSP will provide board certified occupational medicine oversight for the program and will approve medical surveillance protocols.

The United States and Canada locations will follow all requirements of this program.

International locations will follow sections B.1,2,3,5,6,7,8; G.3; and H.1 of this program.

4. Requirements

A. Selection of program participants.

1. The Medical Surveillance Evaluation (MSE) form provides the primary guidance for determining whether medical screening is required for an employee and the frequency of periodic exams. The MSE is to be completed by the employee and their supervisor at time of hire for any employee who may work outside an office environment and is to be reviewed for accuracy at each annual performance review. Other reviews are required whenever there is a change in job tasks.

2. Additional site/project specific biological monitoring or toxicological screening may be required in addition to this program's core exam schedule. These medical tests will be specified by the project-specific health and safety plan and will be authorized by the MSP on the exam appointment protocol. Note: See section D.2 if employee will have an initial assignment at a HAZWOPER site.

B. Types of medical screening and surveillance exams

1. A baseline or preassignment baseline exam will be conducted prior to the start of work assignments requiring medical surveillance.

2. Periodic exam schedules are established by the MSP using the following criteria:

    a. Employees performing the following types of work will receive annual exams: construction activities in the exclusion zone of HAZWOPER sites, field work activities in the exclusion zone of HAZWOPER sites for 30 or more days per year, projects involving exposure to OSHA-regulated materials at or above established action levels.

    b. Employees performing the following types of work will receive biennial exams: field work activities at HAZWOPER sites less than 30 days per year; waste disposal activities; non-HAZWOPER environmental sampling; chemistry laboratory, pilot plant projects, or bench scale operations for 30 or more days per year.

3. Employees currently participating in an examination program will receive exit exams when they leave their work assignment as identified in the Exit Exam Determination. In the event an employee declines the exit exam, the employee will be requested to sign a Waiver of Exit Medical Surveillance Exam.

4. Department of Transportation (DOT) exams will be conducted biennially when an employee is assigned to drive a vehicle with a gross weight rating of more than 10,000 pounds or when driving a placarded vehicle of any size used to transport hazardous chemicals. DOT exam certification can be added to a routine baseline or periodic exam protocol when scheduling with the MSP.

5. When noise levels in the employee's work environment equal or exceed an 8-hour time-weighted average of 85 decibels as measured on the A-scale (dBA), annual audiograms will be performed. For employees involved in construction activities or management of construction, enrollment in this program will be required if more than 50% of their time is spent in an active construction area.

6. Individual radiation dose monitoring will be conducted as required by the site-specific health and safety plan with approval by a Radiation Safety Officer. Personal dosimetry (film badges) are typically required, however, depending on the specific radiation hazard, additional excretory monitoring or thyroid scans may be required.

7. In order to determine an employee's ability to wear a respirator, a medical evaluation will be performed before an employee is fit tested or assigned to wear a respirator.

8. Employees assigned to work environments with airborne concentrations of asbestos fibers at or above the established action level will receive asbestos-specific baseline and annual exams. Exit exams will be performed if an exam has not been performed within the past 6 month period or if an employee has medical complaints related to asbestos exposure.

C. Exam protocols

1. The Medical Screening & Surveillance Exam Protocol identifies the medical exam components of this program.

D. Scheduling of exams

1. The Office or Project Manager, usually with assistance of the local H&S Representative, is responsible for contacting the MSP when baseline, exit, and project specific exams are required. The MSP maintains an employee scheduling database for tracking periodic

exams and will contact the employee for scheduling the month their exam is due. These steps are detailed in the Medical Surveillance Exam Process.

2. Construction Services Division employees hired with an initial assignment to work at a OSHA HAZWOPER site whose work duties require passing a physical exam or who have an essential job function of wearing a respirator, will receive a job offer contingent upon passing a preassignment baseline exam. See HAZWOPER & Respirator Preassignment Baseline Exam Process. In the event of an urgent business necessity a temporary clearance to begin work the day of the exam, issued by the local physician and good for 14 days until the MSP physician final clearance is received, may be requested at the time a baseline exam is scheduled through the MSP.

3. If an exam becomes due during an employee's pregnancy, it is advised to defer the exam until after delivery and the employee returns to work from family/medical leave status.

E. Exam Follow Up

1. Following each exam, the MSP will issue a physician's written opinion (Health Status Medical Report) to the site Health & Safety Representative which will include any medical restrictions and address the employee's ability to use personal protective equipment. See Exam Follow Up Procedures.

2. The MSP will mail the exam invoice to the site H&SR who will approve the charge and forward the invoice to the accounts payable department for payment.

3. The MSP will mail an exam results letter that is confidentially addressed to the employee at their home address within 30 days of the exam date.

F. Emergency Medical Care

1. Preplanning is essential to a prompt and proper response to a medical emergency. Site specific emergency procedures will be provided in the site Health & Safety Plan. See Field First Aid Kit Supply List for recommended supplies. The contents of the first aid kit shall be checked prior to being sent out to each site/project and periodically thereafter to ensure the expended items are replaced.

2. A MSP occupational physician can be reached 24 hours a day for phone consultation at 1-800-455-6155.

3. A workers' compensation claim should be filed by the Human Resource Representative with St. Paul Fire and Marine Insurance (1-800-787-2851) for an injured employee who receives professional medical care or who is disabled from working beyond the initial date of injury.

4. In order to comply with OSHA reporting regulations, immediately notify the OHS or a Division Health & Safety Manager if there is a work-related hospitalization or death.

G. Medical Records

1. Medical records are maintained and preserved in confidential, locked files in the custody of the MSP for at least the duration of employment plus 30 years. Only information regarding the employee's ability to perform the job assignment will be provided to company representatives.

2. Upon request, each employee (or designated representative) will have access to the employee's medical record. Prior to the release of health information to the employee (or designated representative), a specific written consent must be signed by the employee.

3. International records (excluding the United States and Canada) will be maintained in country at the local clinic.

H. Program evaluation

1. The OHS and Division Health & Safety Managers will evaluate this program annually and as needed. Issues to review include program efficacy and efficiency, employee satisfaction, and cost effectiveness.

2. The MSP will prepare an Annual Medical Trending Report specifying the number and types of exams performed and anonymous statistical exam results in group data format.

3. Each employee is mailed a Post-Exam Evaluation by the MSP. Employee feedback regarding the clinic, medical staff, and exam

procedures are reviewed and corrective actions are identified and acted upon as needed.

5. Documentation Summary

The H&SR will file the Medical Surveillance Evaluation and the Health Status Medical Report in the site health & safety records.

6. Resources

A. U.S. OSHA Technical Links - Medical Screening/Surveillance

B. U.S. OSHA Publication 3162 (1999) Screening and Surveillance: A Guide to OSHA Standards

C. Attachment 24-1 WorkCare Medical History Questionnaire

D. Attachment 24-2 Medical Surveillance Evaluation

E. Attachment 24-3 Medical Screening & Surveillance Exam Protocol

F. Attachment 24-4 Medical Surveillance Exam Process

G. Attachment 24-5 HAZWOPER/Respirator Preassignment Baseline Exam Process

H. Attachment 24-6 Exit Exam Determination

I. Attachment 24-7 Waiver of Exit Medical Surveillance Exam

J. Attachment 24-8 Exam Follow Up Procedures

K. Attachment 24-9 Field First Aid Kit Supply List

L. SMS 8 Asbestos Survey and Oversight Operations

M. SMS 17 Hazardous Waste Operations

N. SMS 42 Respiratory Protection

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

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 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.

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

URS **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.

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

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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 will 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.

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.

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)

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

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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)

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.

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)

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

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

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 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.

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

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.

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.

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

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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. t 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.

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.

   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.

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, 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

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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.

- 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 hemoprotozoan 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-

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.

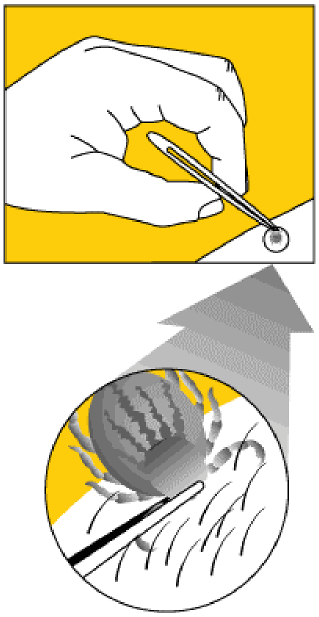
c. Tick Check

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 to 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.



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 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 in 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.

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.

- 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 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.

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.

- 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**

DOT Shipping

1. Applicability

Office and field operations that ship hazardous materials (HazMat) must follow this Hazardous Material Shipping Program.

Hazardous materials may include, but are not limited to, compressed gases, laboratory reagents, field samples, hazardous wastes, and materials used for bench scale and pilot plant operations.

2. Purpose and Scope

This program was designed to provide a framework for compliance with the requirements of the U.S. Department of Transportation (DOT) 49 CFR and the International Air Transportation Association (IATA) for shipping hazardous materials by land or air.

3. Implementation

Office Locations -	The Office Manager is responsible for implementing this program at company locations/facilities.
Field Activities -	The Project Manager is responsible for compliance and implementation of this program at project sites.

4. Requirements

A. Staffing

Each project or location must ensure that awareness and function specific trained individuals are involved in the process of preparing hazardous materials for shipment.

Each location where HazMat shipping occurs or where HazMat employees are assigned must identify a local or regional Shipping Specialist.

B. General Procedures

1. Select the best way to ship the HazMat item based on the quantity, hazard(s), and mode of transportation (e.g., air, land, water).
2. Ensure package contents are compatible.
3. Package, mark, and label according to applicable regulations.

4. Complete the bill of lading or shipper’s declaration for dangerous goods according to applicable regulations.

5. Follow hazard communication requirements:

    a. Send a copy of the appropriate Emergency Response Guidebook page or material safety data sheet (MSDS) with each shipment.

    b. Include the 24-hour emergency response phone number (CHEMTREC 800-424-9300 domestic, 703-527-3887 international) on the shipping paperwork.

C. Placarding Requirements

1. Placards must be offered to drivers if the amount of hazardous materials being shipped exceeds 1,000 pounds.

2. For extremely hazardous materials (e.g., severe explosives and toxics), any amount requires placarding.

3. "Limited quantities" are excepted from placarding.

4. URS employees transporting hazardous materials meeting DOT tracking and shipping requirements will obtain the proper Commercial Drivers License and endorsement.

D. Training

1. Require employees who package, prepare paperwork, load and/or unload, and transport hazardous materials be trained to the appropriate level of activity:

    a. Training is required prior to performing HazMat shipping activities.

    b. Training is required when regulatory changes impact current procedures and every 2 years.

    c. General awareness training is required for everyone who is involved in HazMat shipping. This training includes:

        1. Recognizing hazardous materials

        2. Penalties for not complying

3. Basic regulatory requirements

d. Function specific training is required to ensure employees can perform the specific HazMat jobs safely and in compliance with applicable regulations.

e. Driver's may be exempt from function specific training if the DOT's Materials of Trade (MOT) exception applies to the shipment. (See Attachment 48-1 for information on this exception).

E. Special Requirements

1. Some countries and transporters have more stringent requirements than DOT or IATA. For example, the United Parcel Service (UPS) publishes its own Guide for Shipping Ground and Air Hazardous Materials. URS shipping training and this program may not meet these additional requirements.

2. Contact the applicable shipping company or a URS Health and Safety Program Representative if you are unsure or suspect there may be additional, special requirements on a shipment.

3. For international shipments an expediter may be required to ensure needed materials are not held in customs. It may be advisable to purchase hazardous materials once you arrive in your destination country.

5. Documentation

All files must be kept in a central location.

A. Training records

1. Sign-up sheet with list of employee names, date, management certification.
2. Successfully completed tests.
3. Outline of course materials.

6. Resources

A. 49 Code of Federal Regulations, Parts 171-180, Subchapter C--Hazardous Materials Regulations.

B. Dangerous Goods Regulations. International Air Transport Association. 40th Edition. Effective January 1, 1999.

C. International Maritime Dangerous Goods Code. International Maritime Organization, Amendment 29-98.

D. DOT Office of Hazardous Materials Safety

E. URS HazMat Shipping Support Helpline 800.381.0664

F. Attachment 48-1 - Materials of Trade Summary

G. DOT Hazmat Certificate of Registration

SMS 049
Issue Date 5/08/01
Revision 1

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;

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

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

       AIG Claim Services @ 1-877-366-8423

5. Corporate Health and Safety Management

   The Occupational Health Specialist (OHS), Corporate Health and Safety Director, and Construction Services Division Safety and Health Director will review all reported incidents (U.S.-based employees only) to determine OSHA reporting and recording requirements. All decisions will be based strictly on current Federal OSHA guidelines.

    a. Official records (including required reports, logs, for all reported incidents will be maintained at one central location by the OHS.

    b. The OHS will send each establishment any required government report for their establishment following receipt of an incident report.

c. Each January the OHS will prepare and distribute, to each URS establishment, the appropriate government injury/illness reports. These reports will summarize all required government information for incidents that occurred during the preceding calendar year. Each establishment will post these reports in a prominent location for the time specified by current regulations.

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

http://www.osha.gov/

SMS 051
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Revision 0

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

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.

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.

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)

(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)

URS SAFETY MANAGEMENT STANDARD

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:

- 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

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.

- 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)

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

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.

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

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:

- <u>Hypothermia</u>: 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.
- <u>Frost Bite</u>: 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° to104° F or 38° to 40°C) water. Do not massage or rub the frostbite area. After

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.

- 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"

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.

Attachment 59-2(a)
Wind-Chill Index[1]
(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 (Danger from freezing of exposed flesh)			Great Danger		

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[1] Source: Fundamentals of Industrial Hygiene, Third Edition. Plog, B.A., Benjamin, G.S., Kerwin, M.A., National Safety Council, 1988

Attachment 59-2(b)
Wind-chill Index[1]
(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	-25	-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).

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"

ATTACHMENT D

FORMS

URS

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.

URS	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.

2. Worker Compensation Experience Information

   a) List you Interstate Worker Compensation Experience Modification Rate (EMR) for the last three full years below:

Year	EMR	Carrier	Policy Number

Intrastate (List statistics for highest EMR state)

Year	EMR	Carrier	Policy Number

   b) We require verification of your EMR. Please attach the endorsement page from your policy listing your EMR, or have your insurance carrier or broker provide this information on their letterhead.

   c) If your EMR is 1.0 or exceeds 1.0 for any one or more years above, please explain:

3. Workplace Injuries and Illnesses

	YEAR	YEAR	YEAR
PROVIDE THE FOLLOWING INFORMATION:			
A. Number of Fatalities[1]			
B. Number of cases that involved days away from work, or days of restricted work activity, or both (Totals from Columns 2 and 9)			
C. Number of cases involving recordable cases without lost or restricted workdays (Totals from Columns 6 and 13)			
D. Total Recordable Cases (Sum of Items A, B, and C above for each given year)			

---

[1] Attach description of Event

	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) = $\frac{\text{Total Cases (Item D) x 200,000}}{\text{Total hours worked (Item E)}}$

[3] Lost Workday Case Incident rate = $\frac{\text{Total Lost Workday Cases (Item B) x 200,000}}{\text{Total hours worked (Item E)}}$

5. Has your company received any Willful violations? ☐ Yes ☐ No

6. Does your company maintain a written Health and Safety program? ☐ Yes ☐ No
   If yes please include a copy of the Table of Contents.

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? ☐ Yes ☐ No
   (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.)

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).

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

Project Manager: ________________________

Pass

Signature: ______________________________

Fail

Date: ___________________________________

URS	Health and Safety Program SUBCONTRACTOR EVALUATION CRITERIA	Attachment 46-2

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 it's 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.

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.

URS	Health and Safety Program **INCIDENT REPORT FORM**	Attachment 49-1 Revised: 5/08/01

ADMINISTRATIVE INFORMATION:

URS Division/Company: ____________________

Project Office: ____________________

Project Number: ____________________

Date/Time of Incident: ____________ ____________

Location/Client: ____________ ____________

FOR INJURIES / ILLNESSES:

Name of Injured Employee ____________________

Job Title ____________________

Phone Number ____________ 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.)

URS	**Health and Safety Program** **INCIDENT REPORT FORM**	Attachment 49-1 Revised: 5/08/01

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 512-419-6413)
- Local Human Resources (Injury / Illness cases only)

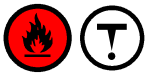
CORRECTIVE ACTONS (*For Internal Use Only*):

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS

BETCO

Material Safety Data Sheet

WHMIS (Pictograms)	WHMIS (Classification)	HCS
	**CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).** **CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).**	Class: Irritating substance. Class: Combustible liquid having a flash point between 37.8°C (100°F) and 93.3°C (200°F).

Section 1. Chemical Product and Company Identification

Product Name/ Trade name	**CitruSolv Concentrate**
Synonym	Natural Degreaser/Deodorizer
Chemical Family	Not available.
Chemical Formula	Not applicable.
Manufacturer	Betco Corporation 1001 Brown Avenue Toledo, Ohio 43607 (419) 241-2156
TSCA	**TSCA Inventory: All components listed or are exempt from listing.**
DSL	**DSL : All components listed unless noted elsewhere on this MSDS**

Code	209
CAS #	Mixture.
Validation Date	**2/8/2001**
Print Date	2/12/2001
In Case of Emergency	Chemtrec (800) 424-9300

Protective Clothing

Section 2. Composition and Information on Ingredients

Name	CAS #	% by Weight	Exposure Limits	LC$_{50}$/LD$_{50}$
1) Citrus Terpenes	5989-27-5	95-100	Not available.	Not available.
2) Nonionic Surfactant	9016-45-9	0-5	Not available.	Not available.
3) Coconut Diethanolamide	8051-30-7	<1	Not available.	Not available.

Section 3. Hazards Identification

Potential Acute Health Effects	This product may irritate eyes and skin upon contact. Harmful if swallowed. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath.
Potential Chronic Health Effects	not available
Carcinogenic Effects	Not classified or listed by IARC, NTP, OSHA, EU and ACGIH.

Section 4. First Aid Measures

Eye Contact	Flush eyes with large quantities of water. Seek medical attention if irritation persists.
Skin Contact	Remove contaminated clothing. Flush with water. Seek medical attention if irritation occurs.
Inhalation	Get to fresh air. Seek medical attention if irritation persists.
Ingestion	Have conscious person drink several glasses of water or milk. DO NOT induce vomiting. Seek medical attention.

Section 5. Fire Fighting Measures

Products of Combustion	Not Applicable
Fire Fighting Media and Instructions	Foam, CO2, or dry chemical.
Special Remarks on Fire Hazards	Do not use water.
Special Remarks on Explosion Hazards	Drums heated by a fire can explode.

Section 6. Accidental Release Measures

Small Spill and Leak	Safety glasses.
Large Spill and Leak	Absorb with DRY earth, sand or other non-combustible material.
Personal Protection in Case of a Large Spill	Be sure to use a MSHA/NIOSH approved respirator or equivalent. Gloves (impervious). Face shield. Boots.

Section 7. Handling and Storage

Precautions	Avoid breathing vapors or spray mists. Avoid contact with skin and eyes. DO NOT ingest.
Incompatibility	acids, oxidizing materials,Iodine pentaflouroethylene
Storage	Keep out of reach of children. For Institutional and Commercial Use Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	Good general ventilation should be sufficient to control airborne levels.
Personal Protection	
Eyes	Splash goggles.
Body	No special protective clothing is required.
Respiratory	Wear appropriate respirator when ventilation is inadequate.
Hands	Gloves.
Protective Clothing (Pictograms)	
Exposure Limits	Not available.

Section 9. Physical and Chemical Properties

Physical State and Appearance	Liqiud
Molecular Weight	Not applicable.
pH	Not available.
Boiling/Condensation Point	340°F initial
Melting/Freezing Point	
Critical Temperature	Not available.
Instability Temperature	Not available.
Specific Gravity	0.85 (Water = 1)

Odor	Pleasant.
Taste	
Color	Colorless.

Vapor Pressure	<10mm Hg @ 68°F
Vapor Density	>1 (Air = 1)
Volatility	90
VOC	>95%
Evaporation Rate	Less than Butyl acetate.
Odor Threshold	Not available.
LogK$_{ow}$	Not available.
Ionicity (in Water)	Not available.
Dispersion Properties	Not available.
Solubility	Soluble
The Product is:	COMBUSTIBLE.
Auto-ignition Temperature	Not available.
Flash Points	CLOSED CUP: 51.667°C (125°F).
Flammable Limits	Not Determined
Fire Hazards in Presence of Various Substances	COMBUSTIBLE.
Explosion Hazards in Presence of Various Substances	Drums Heated By Fire Can explode

Section 10. Stability and Reactivity Data

Stability	Stable
Incompatibility with Various Substances	acids, oxidizing materials,Iodine pentaflouroethylene
Hazardous Decomposition Products	None Known

Section 11. Toxicological Information

Routes of Entry		Eye Contact Ingestion. INHALATION Skin contact.
Toxicity to Animals		Irritant.
Acute Effects on Humans		
	Eyes	Eye irritant. May cause redness, burning, or tearing.
	Skin	Defatting to skin with prolonged or repeated contact.
	Inhalation	May be irritating to mucous membranes of the nose, throat, and lungs.
	Ingestion	May be irritating to the mouth, throat, and gastrointestinal system.
Chronic Effects on Humans		not available
Special Remarks on Toxicity to Animals		No additional remark.
Special Remarks on Chronic Effects on Humans		Chemical pneumonitis.

Section 12. Ecological Information

Ecotoxicity	Not Available
BOD5 and COD	Not Available
Products of Biodegradation	Not available.
Toxicity of the Products of Biodegradation	Not Applicable
Special Remarks on the Products of Biodegradation	No additional remark.

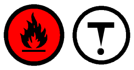
Section 13. Disposal Considerations

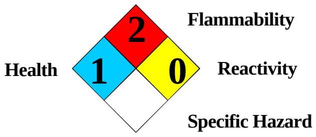
Waste Information	Waste must be disposed of in accordance with federal, state and local environmental control regulations.
Waste Stream	Not available.

Section 14. Transport Information

DOT (U.S.A) (Pictograms)	
TDG Classification	3 
PIN UN, Proper Shipping Name, PG	Shipping name: Flammable liquids n.o.s./Combustible Liquids UNNA: 1993 PG: II
Maritime Transportation	Not available.
Special Provisions for Transport	Not available.

Section 15. Other Regulatory Information and Pictograms

WHMIS (Classification)	CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F). CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).	
Regulatory Lists	No products were found.	
Other Regulations	OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).	
Other Classifications	**HCS (U.S.A.)**	Class: Irritating substance. Class: Combustible liquid having a flash point between 37.8°C (100°F) and 93.3°C (200°F).
	USA Regulatory Lists	SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Citrus Terpenes: fire, immediate health hazard
	DSD (EEC)	R10- Flammable.
	International Regulations Lists	No products were found.



Section 16. Other Information

Validated by CRushton on 2/8/2001.

Verified by CRushton.

Printed 2/12/2001.

Information Contact

Betco Corporation
1001 Brown Avenue
Toledo, Ohio 43607

Continued on Next Page

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: 703-527-3887

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.

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Water

MSDS Number: W0600 --- *Effective Date: 11/12/01*

1. Product Identification

Synonyms: Hydrogen oxide; Dihydrogen oxide; Distilled water
CAS No.: 7732-18-5
Molecular Weight: 18.02
Chemical Formula: H2O
Product Codes: J.T. Baker: 4218, 4219, 6906, 9823
Mallinckrodt: 6795, H453, V564

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Water	7732-18-5	100%	No

3. Hazards Identification

Emergency Overview

Not applicable.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 0 - None
Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight
Contact Rating: 0 - None
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Green (General Storage)

Potential Health Effects

Water is non-hazardous.

Inhalation:
Not applicable.
Ingestion:
Not applicable.
Skin Contact:
Not applicable.
Eye Contact:
Not applicable.
Chronic Exposure:
Not applicable.
Aggravation of Pre-existing Conditions:
Not applicable.

---

4. First Aid Measures

Inhalation:
Not applicable.
Ingestion:
Not applicable.
Skin Contact:
Not applicable.
Eye Contact:
Not applicable.

---

5. Fire Fighting Measures

Fire:
Not applicable.
Explosion:
Not applicable.
Fire Extinguishing Media:
Use extinguishing media appropriate for surrounding fire.
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

Non-hazardous material. Clean up of spills requires no special equipment or procedures.

7. Handling and Storage

Keep container tightly closed. Suitable for any general chemical storage area. Protect from freezing. Water is considered a non-regulated product, but may react vigorously with some specific materials. Avoid contact with all materials until investigation shows substance is compatible.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Not applicable.
Ventilation System:
Not applicable.
Personal Respirators (NIOSH Approved):
Not applicable.
Skin Protection:
None required.
Eye Protection:
None required.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Odorless.
Solubility:
Complete (100%)
Specific Gravity:
1.00
pH:
7.0
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
100C (212F)
Melting Point:
0C (32F)
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
17.5 @ 20C (68F)

Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Not applicable.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong reducing agents, acid chlorides, phosphorus trichloride, phosphorus pentachloride, phosphorus oxychloride.
Conditions to Avoid:
No information found.

11. Toxicological Information

For Water: LD50 Oral Rat: >90 ml/Kg. Investigated as a mutagen.

```
--------\Cancer Lists\---------------------------------------------------------
                                              ---NTP Carcinogen---
Ingredient                                    Known    Anticipated    IARC Category
------------------------------------          -----    -----------    -------------
Water (7732-18-5)                              No          No             None
```

12. Ecological Information

Environmental Fate:
Not applicable.
Environmental Toxicity:
Not applicable.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be flushed to sewer. If material becomes contaminated during use, dispose of accordingly. 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
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: No Chronic: No Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
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.

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16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
Not applicable.
Label Precautions:
Keep in tightly closed container.
Label First Aid:
Not applicable.
Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3.

Disclaimer:

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Date Prepared: 2/13/97
Date Revised: 11/01/01
MSDS

HYDROCHLORIC ACID

1. Chemical Product Identification
Material Identity
Product Name: HYDROCHLORIC ACID
General or Generic ID: MURIATIC ACID

Omega Chemistries 7623 North 67th Ave Suite 301 Glendale, AZ 85301 Bus: 623-842-9304 Fax: 623-842-4983	Emergency Telephone Number 602-686-9252 24 hours

2. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient Name:	CAS #	Weight %
Hydrogen Chloride	7664-93-9	15-35
Water	7732-18-5	65-85

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
Severity of injury will depend on quantity, concentration and duration of contact. Both liquid and vapor contact can cause irritation, corneal burns, and conjunctivitis. Permanent damage with loss of sight can occur.

Skin
Severity of injury will depend on quantity, concentration and duration of contact. Liquid contact: can cause severe burns, pain and brownish or yellow stains. Solution contact: May cause irritation, dermatitis or burns. Vapor contact can cause irritation or burns. Mist contact can cause irritation.

Swallowing:
Ingestion can cause irritation and corrosive burns to the gastrointestinal tract. May perforate stomach or esophagus in extreme cases. Asphyxia may occur from edema of the larynx.

Inhalation:
Inhalation of fumes or mists can cause irritation or corrosive burns to the upper respiratory system. Intense tearing, coughing, throat irritation, sneezing and labored breathing may occur. Following high exposures, lung irritation and pulmonary edema can also occur, sometimes delayed. Concentrations of 0.13 to 0.2% of hydrogen chloride in air can be lethal to humans in a few minutes.

Delayed Effects
Excessive exposure, repeated or prolonged, may cause erosion of the teeth; Gastritis and chronic bronchitis among workers exposed to hydrochloric acid have been reported.

Target Organ Effects
No data

Developmental Information

No data

Cancer Information

No data

Other Health Effects

No data

Primary Route(s) of entry

No data

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4. FIRST AID MEASURES

Eyes

Immediately flush with plenty of water for at least 15 minutes. Hold eyes open by separating eyelids with fingers to assure adequate flushing. Speed is essential. Do not use chemical antidotes. GET MEDICAL ATTENTION!

Skin

Immediately flush affected area with plenty of water for at least 15 minutes, while removing any contaminated clothing. Deluge showering is required if exposure to liquid acid is extensive. Speed is essential. GET MEDICAL ATTENTION! Destroy clothing.

Ingestion

If conscious and free of convulsions, give large amounts of water immediately. DO NOT INDUCE VOMITING! Give a non-gassing neutralizer, such as milk, milk of magnesia of calcium hydroxide. Don not give carbonates, bicarbonates or chalk. GET PROMPT MEDICAL ATTENTION.

Inhalation

Promptly remove to fresh air! If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen, provided a qualified operator is available. GET PROMPT MEDICAL ATTENTION.

Note to Physicians

Treat according to symptoms present.

---

5. **FIRE FIGHTING MEASURES**

Flash point

Not applicable

Exposure limit

Not applicable

Auto Ignition Temperature

Not applicable

Unusual Fire and Explosion Hazards

Hydrochloric acid reacts with steel and most other metals to generate hydrogen gas, which is a serious fire and explosive hazard.

Fire Fighting Precautions

Use NIOSH - approved, self-contained breathing apparatus with full-face piece and protective clothing. Use water spray to cool fire- exposed containers. Take precautions so as not to splash this material onto other personnel.

6. **ACCIDENTAL RELEASE MEASURES**

SPILLS OR LEAKS

(Always wear recommended personal protective equipment.) Provide for adequate ventilation. Fully protected personal should cautiously dilute small spills or leaks with plenty of water. Carefully neutralize the dilute liquid with caustic soda, lime or other alkaline material. Dilution and neutralization procedures will generate heat. For major spills, keep unprotected personnel away. Contain the acid by diking the spill with soil or clay or there suitable material. Recover the acid, if possible. Cautiously dilute and neutralize as described above. Attempt to keep acid out of the sewer.

7. **HANDLING AND STORAGE**

Normal Handling

Always wear recommended personal protective equipment.) Do not get in eyes, on skin or on clothing. Avoid breathing mist and vapor.
Store in approved container only. Store in a dry, well-ventilated area away from heat, out of sun and away from oxidizing substances (Nitric acid, etc.) or other incompatible materials. Diking of storage tanks is recommended. Elevated temperatures will increase vapor pressure of product; use care when opening container.

8. **EXPOSURE CONTROL/ PERSONAL PROTECTION**

Engineering Handling

Provide corrosion- resistant ventilation sufficient to reduce acid mist and vapor concentrations to or below current TLV levels. Packaging and unloading areas and open processing equipment may require mechanical exhaust systems or local exhaust.
Personal Protection:

Skin

Prevent any contact of liquid with body. As a minimum, wear acid-resistant apron and gauntlet gloves, protective clothing and rubber boots for routine product handling and use. For increased protection, include acid-resistant trousers and jacket. Diluted solutions also require such protection. Wash contaminated clothing before reuse.

Respiratory Protection

Where required, use a respirator approved by NIOSH for hydrogen chloride gas and/or mist, as applicable. Some exposures may require use of an NIOSH-approved, self-contained breathing apparatus, or supplied air.

Eyes and Face

As a minimum, wear hard hat, chemical safety goggles, and full-face plastic shield. Do not wear contact lenses.

Additional Recommendations

Provide eyewash stations and quick-drench shower facilities convenient to areas of handling, use or storage. Keep neutralization supplies and equipment for handling spills at hand.

Exposure Guidelines

Ingredient Name	ACHIH TLV	OSHA PEL	OTHER LIMIT
Hydrogen Chloride	5 ppm - Ceiling	5 ppm- ceiling	none

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point
20^o Be = 83^o C
22^o Be = 61^o C
Vapor Pressure 10.10^o Be =.03 mm Hg at 20^o C
20^o Be = 25mm Hg at 20^o C
22^o Be = 84mm Hg at 20^o C
Vapor Density
Air = (1.0) 1.27
Specific Gravity
(Water = 1.0) 20^o Be = 1.16 *20^o Be = 31.5% HCL
22^o Be = 1.18 22^o Be = 35.2% HCL
10.10^o Be = 1.07 10.10^o Be = 15% HCL
Liquid Density
Not applicable
Percent Volatile
15 -35 (HCL only)
Evaporation Rate
< 1 Compared to: Ether
Appearance
Clear water white
Physical State
Liquid
Molecular Weight
36.46 for anhydrous HCL
Odor
Pungent
Chemical Formula
HCL (15-35 wt. % in water
Solubility in Water
pH: 0.8 (1% solution)

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Will not occur
Hazardous Decomposition
Hydrogen chloride vapors (released normally at ambient conditions) are released in increasing amounts at higher temperatures. Will release hydrogen when in contact with some metals.
Normally Stable? (Conditions to Avoid)
Stable under normal conditions. Avoid elevated temperatures (increase vapor pressure of product; may rupture container.)
Incompatibilities
Most metals: yields hydrogen gas: Alkalis, metallic oxides, amines, ethers, and certain other organic such as beta-propiolactone, propylene oxide: causes exothermic reactions, possibly violent. Carbonates, cyanides, and sulfides: yields toxic gases. Water- reactive materials, such as sulfuric acid, oleum and acetic anhydride: causes exothermic reaction

11. TOXICOLOGICAL INFORMATION

Immediate (Acute) Effects

LC_{50} (inhale-rat): 3124 ppm/1hr
LD_{50}(oral rabbit): 900 mg/kg

Delayed Effects (Subchronic & Chronic)

May cause erosion of teeth. Gastritis and chronic bronchitis have also been reported

---

12. ECOLOGICAL

Ecotoxcity

Not available

Environmental Fate

Not available

Degradability

Not applicable -inorganic

Aquatic toxicity

282 ppm/96hr/mosquito fish/TLm/fresh water: 100-330ppm/ 48hr/ shrimp/ LC_{50}/salt water

13. DISPOSAL CONSIDERATIONS

Disposal Considerations

Waste muratic acid (28-35%) should be cautiously diluted with water and neutralization with an alkali. Neutralized waste must be disposed of in accordance with applicable disposal regulations. Users should review their operations in terms of applicable federal, state and local laws and regulations, then consult with appropriate regulatory agencies before discharging or disposing of waste material. Waste may have to be disposed of by an approved contractor.

---

14. TRANSPORT INFORMATION

SARA Title III/CERCLA

Rqs & TPQs (Reportable Quantities) and/or (Threshold Planning Quantities) exist for the following ingredients:

Hydrogen Chloride SARA/CERCLA/RO(lbs.) -5000 SARA EHS/TPO(lbs.) -500 (Gas only)

Spills/releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (1-800-424-8802) and to your Local Emergency Planning Committee.

Section 311 Hazard Class

Immediate Delayed

SARA 313 Toxic Chemicals

The following ingredients are SARA 313 “Toxic Chemicals”. CAS #’s and wt% are found in section #2. Ingredient Hydrogen Chloride Comment: as HCL acid

State Right to Know

In addition to the ingredients found in section 2, the following are listed for state right to know purposes: No ingredients listed in this section.

Additional Regulatory Information

DEA listed Precursor and essential chemicals (21 CFR 1310.04)

OSHA Process Safety Management Standard: Highly hazardous Chemicals (29 CFR 1910.119,App A)

AIR LIQUIDE

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas:
Oxygen 0-23.5%; Isobutylene, 0.0005-0.9%

SYNONYMS: Not Applicable
CHEMICAL FAMILY NAME: Not Applicable
FORMULA: Not Applicable
Document Number: 50054

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE:	Calibration of Monitoring and Research Equipment
SUPPLIER/MANUFACTURER'S NAME:	AIR LIQUIDE AMERICA CORPORATION
ADDRESS:	821 Chesapeake Drive Cambridge, MD 21613
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
BUSINESS PHONE:	1-410-228-6400
General MSDS Information	1-713/868-0440
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	
Oxygen	7782-44-7	0 - 23.5%	There are no specific exposure limits for Oxygen.					
Isobutylene	115-11-7	0.0005 - 0.9%	There are no specific exposure limits for Isobutylene.					
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.

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, odorless gas. Releases of this product may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene, a component of this gas mixture, may cause drowsiness and other central nervous system effects in high concentrations ; however, due to its low concentration in this gas mixture, this is unlikely to occur.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	1
FLAMMABILITY	(RED)	0
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		B

EYES	RESPIRATORY	HANDS	BODY
See Section 8			

For routine industrial applications

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this product, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. The chief health hazard associated with this gas mixture is when this product contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space). Under this circumstance, an oxygen-deficient environment may occur. Individuals breathing such an 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 effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN	**OBSERVED EFFECT**
12-16% Oxygen:	Breathing and pulse rate increase, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea, vomiting, collapse, or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death .

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. The most significant hazard associated with this gas mixture when it contains less than 19.5% oxygen is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color. Additionally, Isobutylene, a component of this gas mixture, may cause drowsiness or central nervous system effects in high concentrations ; however, due to its low concentration in this gas mixture, this is unlikely to occur.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to this gas mixture.

TARGET ORGANS: Respiratory system.

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 must be worn.

No unusual health effects are anticipated after exposure to this product, due to the small cylinder size. If any adverse symptom develops after over-exposure to this product, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

4. FIRST-AID MEASURES (Continued)

Victim(s) who experience any adverse effect after over-exposure to this product must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT, (method): Not applicable.

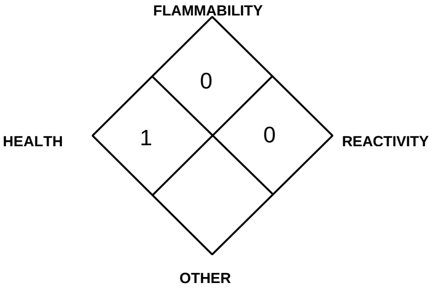
AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):
Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

NFPA RATING



Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this product presents significantly less risk of an oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly-ventilated area; exposures to fatal concentrations of this product could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C; 70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage.

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. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this product in well-ventilated areas. If this product is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of oxygen.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if oxygen levels are below 19.5 % or unknown during emergency response to a release of this product. If respiratory protection is required for emergency response to this product, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: No special protection is needed under normal circumstances of use.

BODY PROTECTION: No special protection is needed under normal circumstances of use.

9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ ft^3 (1.153 kg/m^3)

BOILING POINT: -195.8°C (-320.4 °F)

FREEZING/MELTING POINT @ 10 psig -210°C (-345.8°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906

pH: Not applicable.

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023

MOLECULAR WEIGHT: 28.01

EVAPORATION RATE (nBuAc = 1): Not applicable.

EXPANSION RATIO: Not applicable.

ODOR THRESHOLD: Not applicable.

SPECIFIC VOLUME (ft^3/lb): 13.8

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for this gas mixture.

APPEARANCE AND COLOR: This product is a colorless, odorless gas.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of this product.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Isobutylene include carbon oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this product). Lithium reacts slowly with Nitrogen at ambient temperatures. A component of this product (Isobutylene) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this product:

NITROGEN: There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

ISOBUTYLENE:
LC_{50} (inhalation, rat) = 620,000 mg/kg/4 hours
LC_{50} (inhalation, mouse) = 415,000 mg/kg

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Not applicable.

SENSITIZATION TO THE PRODUCT: This gas mixture is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for this gas mixture.
Embryotoxcity: No embryotoxic effects have been described for this gas mixture.
Teratogenicity: No teratogenicity effects have been described for this gas mixture.
Reproductive Toxicity: No reproductive toxicity effects have been described for gas mixture.

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.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary; treat symptoms; eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this product.

OXYGEN: Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K_{ow} = -0.65
NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plant and animal 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 PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Compressed gases, n.o.s. (Nitrogen, Oxygen)
HAZARD CLASS NUMBER and DESCRIPTION:	2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1956
PACKING GROUP:	Not applicable.
DOT LABEL(S) REQUIRED:	Non-Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

14. TRANSPORTATION INFORMATION (Continued)

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 can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

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

SARA REPORTING REQUIREMENTS: This product is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302	SARA 304	SARA 313
Oxygen	NO	NO	NO
Nitrogen	NO	NO	NO
Isobutylene	NO	NO	NO

SARA THRESHOLD PLANNING QUANTITY: Not applicable.

TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER U.S. FEDERAL REGULATIONS:

- No component of this product is subject to the requirements of CFR 29 1910.1000 (under the 19 89 PELs).
- Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.
- The regulations of the Process Safety Management of Highly Hazardous Chemicals are not applicable (29 CFR 1910.119).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82).
- Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Isobutylene is listed under this regulation in Table 3 as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,553 kg) or greater.

OTHER CANADIAN REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: No.
California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen.
Florida - Substance List: Oxygen, Isobutylene.
Illinois - Toxic Substance List: No.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Oxygen, Isobutylene.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: No.
Missouri - Employer Information/Toxic Substance List: No.
New Jersey - Right to Know Hazardous Substance List: Oxygen, Nitrogen, Isobutylene.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: Oxygen, Nitrogen, Isobutylene.
Rhode Island - Hazardous Substance List: Oxygen, Nitrogen.
Texas - Hazardous Substance List: No.
West Virginia - Hazardous Substance List: No.
Wisconsin - Toxic and Hazardous Substances: : No.

CALIFORNIA PROPOSITION 65: No component of this product is on the California Proposition 65 lists.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. Air Liquide America will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

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 about the handling of compressed gases 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.

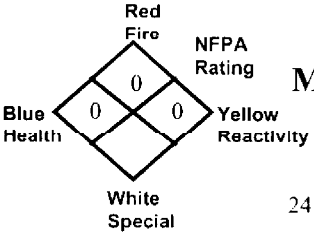
P-1	*"Safe Handling of Compressed Gases in Containers"*
AV-1	*"Safe Handling and Storage of Compressed Gases"*
	"Handbook of Compressed Gases"

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

Fax on Demand: 1-800/231-1366

AIR LIQUIDE™



Liqui-Nox ®

MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street. Suite 309
White Plains, NY 10603
24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	LIQUI-NOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 1999
Chemical Family:	Anionic Liquid Detergent
Manufacturer Catalog Numbers for sizes	1232, 1201, 1215 and 1255

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in LIQUI-NOX" as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	214°F
Vapor Pressure (mm Hg):	No Data
Vapor Density (AIR=1):	No Data
Specific Gravity (Water=1):	1.075
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Slower
Solubility in Water:	Completely soluble in all proportions.
Appearance:	Yellow liquid, nearly odorless

IV. FIRE AND EXPLOSION DATA

Flash Point:	None (Cleveland Open Cup)
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Conditions To Avoid:	None
Incompatibility (Materials To Avoid):	Oxidizing agents.
Hazardous Decomposition or Byproducts:	May release SO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? No Skin? Yes Ingestion? Yes
Health Hazards (Acute and Chronic):	Skin contact may prove locally irritating, causing drying and/or chapping. Ingestion may cause discomfort and/or diarrhea.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Prolonged skin contact may cause drying and/or chapping.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. For small spills recover as much as possible with absorbent material and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	No special precautions in storing. Use protective equipment when handling undiluted material.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Not Required
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are recommended.
Eye Protection:	Goggles and/or splash shields are recommended.
Other Protective Clothing or Equipment:	Not required
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

Omega Chemistries
7623 North 67th Ave Suite 301
Glendale AZ 85301
623-842-9304

Material Safety data Sheet (MSDS)

Section 1: Product Identification

Product Name: Nitric Acid

Chemical or common name: Aqua Fortis, Azotic acid, hydrogen nitrate
Chemical Family: Inorganic Acid
Formula: HNO
CAS # 7697-37-2

Section 2: Component Data

Chemical Name: Nitric Acid
CAS#: 7697-37-2
Percentage Range: 60-71%
Hazardous per 29 CFR 1910.1200: YES
Exposure Standars

	OSHA (PEL)		ACGIH(TLV)	
	ppm	mg/cubic-meter	ppm	mg/cubic-meter
TWA:	2	5	2	5
Ceiling:		None		None
STEL:	4	10	4	10

CAS or Chemical Name: Water
CAS Number: 7732-18-5
Percentage Range: 29 – 40%
Hazardous per 29 CFR 1910.1200: NO
Expousure Standards: None established

Section 3: Physical Data

Appearance: Colorless to slightly yellow liquid
Freezing point: -22 to –41 deg C (-7.6 to –42 deg F)
Boiling point: 120 to 122 Deg C. (248 to 252 deg F)
Decomposition temperature: No data
Specific gravity: 1.37 –1.42
Bulk Density: 1.37 – 1.42 (g/cc)
pH @ 25 deg C: < 1 (1% solution)
Vapor pressure @ 25 Deg C: 49-55mm Hg
Solubility in water: complete
Volatiles, percent by volume: 100%
Evaporation Rate: No data
Vapor density: No data
Molecular weight: 63.01 (active ingredient)
Odor: Irritating, suffocating
Coefficient of oil/water distribution: No data

Section 4: Personal protective equipment requirments

Ventilation: Use local exhaust ventilation to maintain levels to below the TLV.

Skin Protection: Wear gloves, boots, apron and face shield with safety glasses. A full impermeable suit is recommended if exposure is possible to large portion of the body.

Other: Emergency eye wash and safety showers must be provided in he immediate work area.

Equipment specifications:

Respirator type:	NIOSH/MSHA approved acid gas full facepiece respirator
Glove type:	Neoprene
Boot type:	Neoprene
Apron type:	Neoprene
Protective Suite:	Neoprene

Section 5: Fire and explosion hazard information

Flammability data:

Flammable:	No
Combustible:	No
Pyrophoric:	No
Flash Point:	None

Autoignition temperature: Not applicable
Flammable limits at normal atmospheric temperature and pressure (percent volume in air)
LEL – not applicable UEL – Not applicable

NFPA ratings:

Health:	3
Flammability	0
Reactivity	0

Special Hazard warning: Oxidizer

HMIS Ratings:

Health:	3
Flammability	0
Reactivity	0

Extinguishing media: Not applicable

Fire fighting techniques and comments: Use water to cool container exposed to fire. Use water in flooding quantities as fog. This material is non-combustible but may ignite or react with many substances.

Section 6: Reactivity Information

Conditions under which this product may be unstable
Temperatures above: No data
Mechanical shock or impact: No
Electrical (static) discharge: No

Hazardous polymerization: Will not occur
Incompatible materials: Reacts with a wide variety of metals (especially when powdered) bases, carbides, sulfides, fulminates, picrates, chlorates, oxidizable inorganic compounds, organic chemicals turpentine, and combustible materials.

Hazardous decomposition products: Nitrogen oxides, hydrogen gas
Other conditions to avoid: heat and light

Summary of reactivity:

Oxidizer:	Yes
Pyrophoric:	No
Organic Peroxide:	No
Water Reactive:	No
Corrosive:	Yes

Section 7: Handling and Storage

Do not take internally; avoid contact with skin, eyes and clothing, upon contact with skin or eyes, wash off with water.
Storage conditions: Store in a cool, dry, well –ventilated area.
Do not store at temperatures above 38Deg C (100 deg F)
Do not expose to direct light.
Product Stability ad compatibility:
Shelf life limitations: 1 year
Incompatible materials for packaging: Polyethylene bottles, metal containers
Incompatible materials for storage or transport: Refer to incompatible materials, Section

Section 8: Fist Aid

Eyes: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Call a physician at once.

Skin: Immediately flush with water for at least 15 minutes. Call a physician. If clothing comes in contact with the product, the clothing should be removed immediately and should be laundered before re-use.

Ingestion: Immediately drink large quantities of water. Do not induce vomiting. Call a physician at once. Do not give anything by mouth if the person is unconscious of if having convulsions.

Inhalation: If person experiences nausea, headache or dizziness, person should stop work immediately and move to fresh air until these symptoms disappear. If breathing is difficult, administer oxygen, keep the person warm and at rest. Call a physician. In the event that an individual inhales enough vapors to lose consciousness, person should be moved to fresh air at once and a physician should be called immediately. If breathing has stopped, artificial respiration should be give immediately. In all cases insure adequate ventilation and provide respiratory protection before the person returns to work.

Note to physician: Delayed pulmonary edema may occur

Section 9: Toxicology and health information

Routes of Absorption:
Oral, dermal, inhalation, eye contact

Warning statements and warning properties
Corrosive to all tissues contacted. May be fatal if swallowed. Harmful if inhaled.

Human threshold response data:
Odor threshold: No data
Irritation threshold: No data
Immediately dangerous to life or health: The IDLH concetration for nitric acid is 100 ppm

Signs and Symptoms, and effects of exposure:

Inhalation:

Acute:
Inhalation of nitric acid mist is severely irritation to the mucus membranes and respiratory tract, the effects of which may not show immediately after exposure. Signs exhibited after inhalation may include dryness in the throat and nose, cough, choking chest pain and shortness of breath. In some individuals, similar or more severe signs may be observed after a latent period of several hours following inhalation. These severe effects may be a bronchopneumonia, severe shortness of breath and or pulmonary edema. Severe exposures have been reported to cause tooth erosion, although these reports are complicated by exposure to multiple acids.

Chronic:
Repeated inhalation at exposure levels greater than currently excepted limits may cause chronic bronchitis and or chemical pneumonitis.

Skin:

Acute:
Direct contact with the liquid is corrosive, producing immediate burns with skin destruction and possible ulceration. A yellow-brown discoloration may appear from contact with dilute and concentrated solutions. High mist concentrations may cause irritation of the skin and possible burns, along with yellow discoloration of the skin.

Chronic:
There is no information available on chronic exposure by this route. Chronic dermal contact with significant amounts of the acid is unlikely because of the corrosive nature of the product.

Eye:

Direct contact with the eye will cause an immediate corrosive action with burns to the cornea and conjuctival epithelia. Permanent eye damage and impairment of vision may result. High mist concentrations may cause mild to severe eye irritation, and in extreme cases, be corrosive to the eye.

Ingestion:

Acute:
Ingestion may cause burns to the mouth, throat and stomach, and gastroenteritis with any or all of the following symptoms. Nausea, vomiting, lethargy, diarrhea, bleeding or ulceration, and may be fatal.

Chronic:
There is no data available on the chronic ingestion of Nitric Acid.

Medical Conditions aggravated by exposure:
Asthma, emphysema, and other respiratory diseases

Interactions with other chemicals which enhance toxicity:
Oxides of nitrogen, which may evolve from fuming nitric acid, may enhance the respiratory effects of nitric acid.

Animal Toxicity:
Acute Toxicity:
Oral LD 50: No data
Dermal LD 50: No data
Inhalation LC 50: 2500 ppm/1hour (rat)

Acute and chronic target organ toxicity:

Studies of acute and repeated exposures to nitric acid in laboratory animals have shown the lung to be the target organ of toxicity.

Reproductive and developmental toxicity:

There are no known or reported effects on fetal development of reproduction from nitric acid exposure in humans. In the literature there are unsubstantiated reports on developmental and reproductive effects in laboratory animals; however these studies were not performed according to accepted protocols or practices.

Mutagenicity:

There are no known or reported studies on the mutagenicty of nitric acid.

Aquatic Toxicity:

The aquatic toxicity of nitric acid is related to the pH of the water which it achieves. For rainbow trout, the reported LC50 is about a pH of 4.0 for a 7 day bipassay. Other reported aquatic toxicity data show TLm values of 180 ppm for the shore crab, 100-300 ppm for the starfish and armed bullhead, and 330-100 ppm for the cockle.

Section 10: Transportation information

This material is regulated a s DOT Hazardous Material
DOT description from the hazardous materials table 49 CFR 172.101:
Land (U.S. DOT) Nitric acid, 8, UN2031
PG I Greater than 70% nitric acid
PG II Less than or equal to 70% nitric acid

Water (IMO):	Same as above
Air (IATA/ICAO):	Forbidden
Hazard Label/Placard:	Corrosive
Reportable quantity:	1000 lbs. (per 49CFR 172.101. appendix)
Emergency Guide NO:	44

Section 11: Spill and Leak procedures

For all transportation accidents, call chemtrec at 800-424-9300.
Reportable quantity: 1000 lbs as 100% nitric acid per 40 CFR 302.4

Spill Mitigation procedures:
Hazardous concentrations in air may be found in local spill area and immediately downwind. Remove all sources or ignition. Stop source of spill if it may be done safely. Evacuate the immediate area and mark off accordingly but only after obtaining the proper personnel protective equipment.

Air release:

Vapors may be suppressed by the use of water fog. All water must be contained and treated as a hazardous waste and or neutralized.

Water Release:

This material is heavier than and soluble in water. Notify all downstream municipal, public, or industrial water users of possible contamination. Create an earthen dike to contain the material if at all possible and treat as necessary.

Land Spill:

Create a dike or containment area using earth, clay, sand, etc. do not use items such as sawdust or wood based absorbents. Dig a trench or packet to contain the material, if necessary and treat/neutralize as soon as possible.

Section 12: Disposal Considerations

If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and wouls have the following EPA hazardous waste number: D001, D002.

If this product becomes a waste, it will be a hazardous waste which is subject to the Land Deiposal Restriction under 40 CFR 268 and must be managed accordingly.

As a hazardous liquid waste, it must be disposed of in accordance with local, state, and federal regulations in permitted hazardous waste treatment, storage and disposal facility by treatment.

Section 14: Additional Regulatory Status information

Toxic Substances control Act:
This substance is listed on the toxic substances control act inventory.

Superfund Amendment and reauthorization act title III:
Hazardous Categories, per 40 CFR 370.2
Health
    Immediate (acute)
Physical:
Fire

Emergency planning and community right to know, per 40 CFR 355, app.a:
Extremely hazardous substance – threshold-planning quantity: 1000 lbs.

Supplier Notification requirements, Per 40 CFR 372.45:

This mixture or trade name product contains a toxic chemical or chemicals subject to the reporting requirements of section 313 or Title III of the superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.

Chemicals listed are: Nitric Acid

Section 15:

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Omega Chemistries makes no representation as to it accuracy or sufficiency. Condition or use are beyond Omega Chemistries control and therefore users are responsible to verify this data under their own operation condition to determine whether the product is suitable for their particular purposes and they assume all risks of their use. Handling and disposal of the product, of from the publication or use, or reliance upon, information contained herein. This information relates only to the product designate herein, and does not relate to its use in combinations with any other material or in any other process.

MATERIAL SAFETY DATA SHEET: SIMPLE GREEN®

I. PRODUCT & COMPANY INFORMATION

PRODUCT NAME: **SIMPLE GREEN® CLEANER / DEGREASER** Page 1 of 4

COMPANY NAME: **SUNSHINE MAKERS, INC.** Version No. 1006
15922 Pacific Coast Highway Issue Date: March, 1999
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 • 562-795-6000
Fax: 562-592-3034
Website: www.simplegreen.com

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.

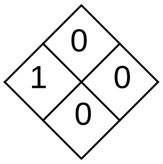
All components of Simple Green® are listed on the TSCA Chemical Substance Inventory.

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:	Nonhazardous

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 2 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 LD_{50} (rat):	>5.0 g/kg body weight
Dermal LD_{50} (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.

	LC_{50} in mg/L (ppm)	
	48-hour	**96-hour**
Marine Fish:		
Mud minnow *(Fundulus heteroclitus)*	1690	1574
Whitebait *(Galaxias maculatus)*	210	210
Marine/Estuarine Invertebrates:		
Brine Shrimp *(Artemia salina)*	610	399
Grass Shrimp *(Palaemonetes pugio)*	270	220
Green-lipped Mussel *(Perna canaliculus)*	220	220
Mud Snail *(Potamopyrgus estuarinus)*	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.

MATERIAL SAFETY DATA SHEET
SULFURIC ACID CR (40%)

CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Omega Chemistries	EMERGENCY PHONE #'S:
7623 North 67th Ave Suite 301	602-686-9252
Glendale, AZ 85301	24 HOURS A DAY
623-842-9304	

COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT	CAS NUMBER	% (BY WEIGHT)
SULFURIC ACID	7664-93-9	40.0
WATER		60.0
GENERIC: INORGANIC ACID		

HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS

EYE	Exposure can cause irreversible eye damage. Symptoms may include stinging, tearing, redness, swelling, corneal damage, and blindness.
SKIN	Exposure can cause irreversible skin damage. Symptoms may include redness, swelling, burns, and severe skin damage.
SWALLOWING	Exposure may be harmful or fatal. Symptoms may include severe stomach and intestinal irritation (nausea, vomiting, diarrhea), abdominal pain, and vomiting of blood. Swallowing this material may cause burns and destroy tissue in the mouth, throat, and digestive tract. Low blood pressure and shock may occur as a result of severe tissue injury.
INHALATION	Exposure to vapor or mist is possible. Exposure may be harmful or fatal. Symptoms may include severe irritation and burns to the nose, throat and respiratory tract.
SYMPTOMS OF EXPOSURE	No data
TARGET ORGAN EFFECTS	No data
DEVELOPMENTAL INFORMATION	No data
CANCER INFORMATION	This product contains sulfuric acid. The international agency for Research on Cancer has listed strong inorganic acid mists containing sulfuric acid as causing cancer in humans.
OTHER HEALTH EFFECTS	No data
PRIMARY ROUTE (S) OF ENTRY	Inhalation, skin contact

FIRST AID MEASURES

EYES	If material gets into the eyes, immediately flush eyes gently with water for at least 15 minutes while holding eyelids apart. If symptoms develop as a result of vapor exposure, immediately move individual away from exposure and into fresh air before flushing as recommended above. Seek immediate medical attention.
SKIN	Immediately flush skin with water for at least 15 minutes while removing contaminated clothing and shoes. Seek immediate medical attention. Wash clothing before reuse and decontaminate or discard contaminated shoes.
SWALLOWING	Seek immediate medical attention. Do not induce vomiting. Vomiting will cause further damage to the mouth and throat. If individual is conscious and alert, immediately rinse mouth with water and give milk or water to drink. If possible, do not leave individual unattended.
INHALATION	If symptoms develop, move individual away from exposure and into fresh air. If symptoms persist, seek medical attention. If breathing is difficult, administer oxygen. Keep person warm and quiet; seek immediate medical attention.
NOTE TO PHYSICIANS	No data

FIRE FIGHTING MEASURES

FLASH POINT	Not applicable
EXPLOSIVE LIMIT	Not applicable
AUTOIGNITION TEMPERATURE	No data
HAZARDOUS PRODUCTS OF COMBUSTION	May form: acid vapors, sulfur dioxide
FIRE AND EXPLOSION HAZARDS	No data
EXTINGUISHING MEDIA	Dry chemical
FIRE FIGHTING INSTRUCTIONS	Water or foam may cause frothing which can be violent and possibly endanger the life of the firefighter. Water may be used to keep fire-exposed containers cool until fire is out. Wear a self contained breathing apparatus with a full facepiece operated in the positive pressure demand mode with appropriate turn out gear and chemical resistant personal protective equipment.
NFPA RATING	HEALTH - 3 FLAMMABILITY - 0 REACTIVITY - 2

ACCIDENTAL RELEASE MEASURES

SMALL SPILL

Cover the contaminated surface with sodium bicarbonate or a soda ash/flaked lime mixture (50-50). Mix and add water if necessary to form a slurry. Scoop up slurry and wash site with soda ash solution. Proper mixing procedures are essential. Trained personnel should conduct this procedure. Untrained personnel should be removed from the spill area.

LARGE SPILL

Persons not wearing protective equipment should be excluded from area of spill until clean-up is completed. Stop spill at source. Dike to prevent spreading. Pump to salvage tank.

HANDLING AND STORAGE

HANDLING

Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed. Addition to water releases heat which can result in violent boiling and spattering. Always add slowly and in small amounts. Never use hot water. Never add water to acids. Always add acids to water.

EXPOSURE CONTROLS / PERSONAL PROTECTION

EYE PROTECTION	Chemical splash goggles and face shield (8″ min) in compliance with OSHA regulations are advised; however, OSHA regulations also permit other type safety glasses.
SKIN PROTECTION	Wear resistant gloves such as: neoprene. To prevent skin contact, wear impervious clothing and boots.
RESPIRATORY PROTECTIONS	If workplace exposure limit(s) of product or any component is exceeded, a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions. Engineering or administrative controls should be implemented to reduce exposure.
ENGINEERING CONTROLS	Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below TLV's.
EXPOSURE GUIDELINES	COMPONENT: SULFURIC ACID(7664-93-9) OSHA VPEL 1.000mg/m3 - TWA ACGIH TLV 1.000mg/m3 - TWA ACGIH TLV 3.000mg/m3 - STEL WATER - no exposure limits established

PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT (for product)	554.0 F (290.0C) @ 760 mmHg	
VAPOR PRESSURE (for product)	.010 mmHg @ 68.00 F	
SPECIFIC VAPOR DENSITY	Not applicable	
SPECIFIC GRAVITY	1.843 @ 60.00 F	
LIQUID DENSITY	15.350 lbs/gal @ 60.00 F	1.843 kg/1 @ 15.60 C
PERCENT VOLATILES	1.0 - 5.0 %	
EVAPORATION RATE	slower than ethyl ether	
APPEARANCE	No data	
STATE	liquid	
PHYSICAL FORM	homogeneous solution	
COLOR	clear, syrupy colorless	

ODOR	No data
pH	No data

STABILITY AND REACTIVITY

HAZARDOUS POLYMERIZATION	Product will not undergo hazardous polymerization
HAZARDOUS DECOMPOSITION	May form: acid vapors, sulfur dioxide
CHEMICAL STABILITY	Stable
INCOMPATIBILITY	Avoid contact with: alkali metals, organic materials, strong alkalies. Acid reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

TOXICOLOGICAL INFORMATION

No data

ECOLOGICAL INFORMATION

No data

DISPOSAL CONSIDERATION

WASTE MANAGEMENT INFORMATION:

Dispose of in accordance with all applicable local, state and federal regulations.

TRANSPORT INFORMATION

DOT INFORMATION - 49 CFR 172.101
DOT DESCRIPTION: SULFURIC ACID, 8, UN2796,PGII
CONTAINER MODE: 55 GAL DRUM/TRUCK PACKAGE
NOS COMPONENT: NONE
RQ (REPORTABLE QUANTITY) - 49 CFR 172.101 - SULFURIC ACID - 1020 LBS.

REGULATORY INFORMATION

US FEDERAL REGULATIONS TSCA (TOXIC SUBSTANCES CONTROL ACT) STATUS	The intentional ingredients of this product are listed.
CERCLA RQ - 40 CFR 302.4	SULFURIC ACID - 1000 LBS. RQ
SARA 302 COMPONENTS - 40-CFR 355 APPENDIX A	SULFURIC ACID -1000 LBS RQ & TPQ
SECTION 311/312 HAZARD CLASS - 40 CFR 370.2	IMMEDIATE (X)
SARA 313 COMPONENTS - 40 CFR 372.65	SULFURIC ACID (ACID AEROSOLS) 7664-93-9 96.00%
INTERNATIONAL REGULATIONS INVENTORY STATUS	NOT DETERMINED
STATE AND LOCAL REGULATIONS:	NJ & PA RTK LABEL: SULFURIC ACID 7664-93-9

OTHER INFORMATION

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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 Geneva-Border City former Manufactured Gas Plant (MGP) site in Border City, New York. The New York State Department of Environmental Conservation's (NYSDEC's) identification code for the site is 8-50-008.

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)*. 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:

- Collect surface soil samples;
- Advancement of soil borings;
- Collect subsurface soil samples;
- Collect groundwater samples using Hydropunch™ procedures;
- Install and develop additional (overburden and bedrock) monitoring wells;
- Collect groundwater samples from monitoring wells;
- Measure groundwater elevations and check wells for NAPL;
- Collect oxide box samples;
- Collect surface water samples; and
- Collect sediment samples.

The remainder of this section describes the procedures that will be followed to complete these tasks.

Non-aqueous phase liquids may be encountered during various phases of this SRI, specifically during soil boring and well installations. 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, 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. 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.

2.1 SUBSURFACE SOIL SAMPLING PROCEDURES

Soil borings will be advanced and continuous overburden soil samples will be obtained to verify the geologic profile and assure proper placement of the well screens. The collection of subsurface soil sampling may be conducted using discrete samplers and MacroCoreϑ open samplers with a Geoprobeϑ unit mounted to a truck or van or using split-spoon samplers during drilling with a conventional drill rig.

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.

2.1.1 Soil Sampling Using Geoprobe J Samplers

Discrete samplers will be used to collect samples obtained with a Geoprobe™. 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 sample 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. Some soil samples from the zero to four foot bgs interval will be collected using MacroCore™ open samplers.

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.

A second aliquot of soil from the sampler will be retained for headspace analysis using a PID. Headspace analysis procedures are described in Section 2.1.3. 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 gloves for the collection and handling of all samples and 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 4E Celsius. The soil samples will be held until all of the borings within an AOC have been advanced. Based on visual and PID screening, at least one sample per AOC will be sent to the lab for analysis.

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 2.11. 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 2.10 and the *QAPP*. The sample custody procedures are described in Section 3.0.

2.1.2 Soil Sampling Using Stainless Steel Split-Spoons

The 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 discrete samplers, described in Section 2.1.1.

Upon completion of sampling at each location, all sampling equipment will be decontaminated in accordance with the procedures described in Section 2.11. 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 2.10 and the *QAPP*. The sample custody procedures for the soil samples are described in Section 3.0.

2.1.3 Headspace Analysis Procedures

Field screening of collected soil samples will be completed using headspace analysis using a photo ionization detector (PID) equipped with a 11.7 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.

2.2 HYDROPUNCH ä SAMPLING PROCEDURES

Groundwater samples will be collected using a drill rig equipped with a Hydropunch™ or equivalent sampler. Some or all of the following equipment will be used during groundwater sampling using a Hydropunch™ sampler:

- Field boring log sheet and field notebook;
- Personal protective equipment (PPE);
- Disposable gloves;
- Distilled/deionized water;
- Cleaning detergents and decontamination chemicals;
- Peristaltic pump;
- New polyethyene tubing;
- New 3/8-inch ID flexible silicone tubing;
- Pre-cleaned stainless steel foot valve;
- 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.

A stainless-steel screen enclosed in a protective sheath is driven until it is manually pushed out at a desired depth. The screen's 0.004-inch slot size filters out most sediments as the groundwater is brought to the surface using polyethylene tubing and a peristaltic pump. If samples will be analyzed for more than one parameter, VOC samples will be collected first. Quality assurance samples, including duplicates, equipment rinseate blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.10 and the *QAPP*. The sample custody procedures for the Hydropunch™ samples are described in Section 3.0.

After the containers are filled, the tubing and stainless-steel screen will be removed from the borehole. The borehole will be filled with cement-bentonite grout or bentonite and hydrated to prevent surface runoff from infiltrating into the subsurface. The location of the sampling location will be marked with a wooden stake or flag for future reference.

The stainless-steel screen will be decontaminated with an Alconox wash and rinsed with distilled water after each usage.

2.3 OXIDE BOX SAMPLING PROCEDURES

The samples from the oxide boxes will be collected via the access panels present in the floor of the meter laboratory. At no time will personnel enter the former oxide boxes. Some or all of the following equipment will be used to collect samples from the oxide boxes:

- 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;
- Laboratory-supplied sample bottles;
- Cooler;
- Sufficient ice or freezer packs to maintain the samples at four degrees Celsius;
- Chain of Custody (COC) forms;
- Stainless-steel hand auger;
- New disposable bailer or beaker;
- New nylon rope; and
- Plastic sheeting.

The liquid sample will be collected first so as to limit the disturbance of the particulate matter present, which would cause an increase in the turbidity and result in increased concentrations in the liquid phase. The liquid sample will be collected using either a dedicated bailer or a beaker. The sample will be transferred to laboratory-supplied sample jars.

Following completion of the liquid sampling, the solid sample will be collected using a stainless steel hand auger. A composite sample will be collected from the top of the solid material to its base. The sampled material will be placed on a sheet of plastic and the material will be mixed to ensure that the sample has been homogenized. The materials will then be transferred to a laboratory supplied sample jar. The stainless-steel hand auger will be decontaminated with an Alconox wash and rinsed with distilled water after each usage.

Quality assurance samples, including duplicate samples of the liquid and the solid samples, will be collected as necessary in accordance with the procedures described in Section 2.11 and the *QAPP*. The sample custody procedures for the oxide box samples are described in Section 3.0.

2.4 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;
- 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;
- Two-inch 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;
- Four-inch PVC casing;
- 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.

2.4.1 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.

All soil boring and well construction details will be properly logged by the supervising field geologist. All notes will be entered on a standard boring log sheet (Attachment A) and 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 in Section 2.11.

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 head-space analysis are described in Section 2.1.3.

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

Overburden monitoring wells will be installed in the unconsolidated material using continuous-flight, 4.25-inch (or larger as necessary) inner diameter (ID) hollow-stem augers (HSAs) for two-inch wells.

URS' field personnel will prepare a soil boring log and maintain 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 problems encountered. The Unified Soil Classification (USC) System will be used for soil descriptions.

After the boring is drilled to the required depth, a string of two-inch, flush-threaded, PVC well riser and screen will be installed through the HSAs. A threaded bottom plug will be placed at 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.

New 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. If significant amount of NAPLs is observed in the soils, larger, four-inch or six-inch diameter well, and possibly steel construction will be considered to allow for more efficient NAPL recovery.

The screen slot size will be selected 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 and will be suited to the smallest grain-size within the screened-interval.

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) (if any) and to allow for observations of seasonal water level fluctuations.

The 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.

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 by adding potable water to the borehole and underspace.
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 Monitoring Well Construction

For each bedrock monitoring well, the boring will be advanced through the overburden materials using drive and wash six-inch steel casing. Standard split spoon sampling will be conducted continuously for the upper 40 feet at locations BR-2 and BR-3. Thereafter, soil samples will be collected at 10 foot intervals to the top of bedrock. The six-inch diameter casing will be seated into the top of the bedrock. Based on previous reports, the top of bedrock is estimated to be at approximately 175 to 200 feet bgs. Once the casing has been seated into the bedrock, the lower portion of the well will be advanced into the bedrock using NX (three-inch OD) coring.

Proposed bedrock wells BR-2 and BR-3 will be installed first. These two bedrock wells will be drilled to a total depth of approximately 336-feet below grade, which is the reported construction depth of the former injection well, plus an addition of ten feet to a total depth of approximately 346 feet. Prior to installing bedrock monitoring wells BR-2 and BR-3, a magnetic survey followed by a ground penetrating radar (GPR) survey will be conducted to attempt to locate the former production well near the reported sludge pit.

During the advancement of wells BR-2 and BR-3, packer sampling will be conducted in bedrock at approximately 30-foot intervals to evaluate the hydraulic properties of the bedrock and to collect groundwater samples for screening of MGP-related contaminants (PAHs only).

Groundwater samples will be collected at 30 feet intervals during coring at monitoring wells BR-2 and BR-3 to evaluate water quality and assess the interval to be screened. The core-hole will be advanced thirty-feet. A single packer will be placed thirty-feet from the bottom of the core-hole. The packered interval will be purged of three volumes in addition to the volume of drilling water lost in the interval during coring, or until dry. A groundwater sample will then be collected for laboratory analysis of PAHs. The laboratory will provide non-ASP deliverables with an expedited one week turn-around time.

No packer sampling will be conducted during drilling at proposed monitoring wells BR-1 and BR-4. The total depth of bedrock monitoring wells BR-1 and BR-4, and the appropriate length of the open bedrock interval will be based on the results of packer tests at wells BR-2 and BR-3. These wells will also be advanced using NX core.

The final depth of each well will be established based on the observations from the bedrock cores, including RQD determinations in the field. Based on the relative difference between zones with high and low calculated RQD values, we anticipate that we will be able to distinguish higher fracture density zones from lower fracture density zones.

When the desired depth for each bedrock monitoring well is reached, the borehole will be reamed with a 5

7/8-inch diameter rollerbit to the top of the desired open interval. Following reaming, a four-inch PVC riser pipe will be grouted into the borehole and allowed to cure for a minimum period of 48 hours prior to reentering the well to core and ream the lower portion of the well to a nominal four-inch diameter. If the casing is to be installed above the bottom of the core hole, the core hole will be partially backfilled with bentonite prior to installing the 4-inch casing to minimize the potential of sealing bedrock fractures with grout in the uncased portion of the well.

Development of each bedrock well will be accomplished using the drilling rig tools. The tools will be moved up and down along the length of the open hole while surging the well with air to remove fines generated during drilling.

If DNAPLs are encountered in the bedrock, the open hole interval of the well will be beneath the DNAPL interval. To ensure that the open hole interval for each deep bedrock monitoring well is below the DNAPL interval, we anticipate that the depth of the open hole interval beneath the DNAPL may range from ten feet at locations with low fracture densities to 30 feet at locations with high fracture densities.

If DNAPL is not visible in the bedrock cores, the boring will be advanced to the anticipated desired depth, as described in the *SRI Workplan*. The four-inch casing will then be installed using a cement-bentonite grout mixture. After the grout has been allowed to cure for at least 48 hours, the remaining open hole interval will be continuously cored using an NX core bit.

After the extent of NAPLs is evaluated, NYSEG and NYSDEC will decide whether and at what locations wells should be installed in NAPL zone(s) (if identified). Wells in NAPL zones will be installed either for potential recovery purposes or for the purpose of evaluating nature of NAPLs in those zones (if identified) for Feasibility Study purposes.

The procedures to install these potential NAPL-containing wells will be the same procedures to install other bedrock monitoring wells.

Wellhead Construction

All wells will be completed with protective stickup risers. A four-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. 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.

The drilling subcontractor will construct a (2 foot x 2 foot x 0.5 foot) concrete apron around each well. Concrete aprons will be sloped to promote runoff away from the well. Concrete pads will be constructed within three days after wells have been installed.

Cuttings will be containerized in the New York State Department of Transportation's (NYSDOT) approved 55-gallon drums and disposed in accordance with relevant regulations by NYSEG. Drilling fluids will also be containerized for off-site disposal. The drums will be labeled and staged on-site.

2.4.2 Well Development

This section describes the groundwater monitoring well development procedures and quality control requirements. The following equipment will be used to develop the newly installed overburden monitoring wells.

- Centrifugal or Waterra inertial pump;
- New high density polyethylene (HDPE) tubing;
- New HDPE foot valves and surge blocks;
- Generator and extension cords with GFI protection;
- ASTM Type II or analyte-free distilled water;
- Water level indicator;
- Five-gallon bucket;
- Polyethylene sheeting;

- Well development record and field notebook; and
- Turbidity meter.

Well development will begin no sooner than 48 hours after grout placement and will be accomplished through a combination of surging and pumping using a centrifugal or Waterra pump. First, the high density polyethylene tubing with a surge block and foot valve will be lowered to the bottom of the well. The tubing will then be attached to the pump and the pump is started. The position of the foot valve will be raised and lowered across the screened interval to remove sediment and drilling fluids from the sand pack.

Development will continue for a maximum of five hours, until the well is pumped dry or until the discharged water contains no visible particles and turbidity is less than 50 NTU. Well development procedures will be documented in the field notebook or on a well development record.

The drilling contractor will develop the bedrock monitoring wells using a drill rig. The monitoring wells will be developed by alternately pumping and air-surging ten-foot intervals. Each interval will be surged until a turbidity of 50 NTU is reached or a maximum time of 30 minutes. Alternately pumping and surging will continue until a minimum of water is recovered equaling the approximate amount of drilling fluid lost during coring and reaming plus five screen volumes.

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 relevant regulations by NYSEG.

2.4.3 Well Surveying

The locations and elevations of all new wells will be surveyed by a New York licensed surveyor, using a United States Geodetic Survey benchmark as a datum. 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.

2.5 GROUNDWATER ELEVATION MEASUREMENT AND NAPL CHECK PROCEDURES

Prior to groundwater sampling, groundwater elevations will be collected for all existing and newly installed monitoring wells. The wells will also be checked for the presence of NAPL. Some or all of the following equipment will be used to collect water level measurements and check monitoring wells for NAPL:

- Electronic water level indicator with 0.01 feet graduations;
- Oil-water interface probe;
- Weighted nylon string or rope;
- Personal protective equipment (PPE);
- Disposable gloves;
- Distilled/deionized water;
- Cleaning detergents and decontamination chemicals; and
- Five-gallon pails for decontamination;

2.5.1 Groundwater Elevation Measurement Procedures

After the new wells have been developed, the new wells and the existing and accessible wells at the site will be gauged using an electronic water level meter or interface probe to obtain water level elevations. The water level data will be used to further refine the groundwater flow regime beneath the site.

Prior to the first water level measurement round, the wells will be checked for the presence of NAPL using a weighted string (see Section 2.5.2). If present, an oil-water interface probe (IP) will be used to measure water levels to minimize the potential of contamination.

The depth to groundwater in the monitoring wells will be measured using an electronic interface probe (i.e., Model P-1 Solinst or equivalent). The electronic interface probe may also be used to detect LNAPL in the wells (Section 2.5.2). Groundwater levels will be measured in all monitoring wells using the following procedures:

1. Verify the identification of the monitoring well.
2. Observe the wellhead for signs of deterioration. Record observations.
3. Identify the surveyed elevation point on the well. If one does not exist, create a mark using a steel file. This mark will be the measuring point for subsequent rounds of water level measurements.
4. Slowly lower the electronic water level indicator probe into the well.
5. When the water level indicator contacts groundwater, note the point on the water level indicator as referenced by the measuring point on the well.
6. Record the water level to within 0.01 foot in the field notebook or gauging form.
7. Retrieve the water level indicator and re-lock the well.
8. Decontaminate the water level indicator after each use with an Alconox/distilled water wash followed by a distilled water rinse.

The order of gauging will be based on the anticipated or known level of contamination in the well. The clean wells will be checked first. The gauging data will be recorded on a gauging form. A copy of a gauging form is provided in Attachment A.

2.5.2 NAPL Check Procedures

All new and existing monitoring wells will be checked for the presence of NAPL. 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 using the procedure described in Section 2.5.1. Each well will also be monitored for the presence of NAPLs using dedicated disposable weighted cords or an IP before purging and sampling.

The procedure for detecting LNAPL using a oil/water interface probe is described below.

1. Verify the identification of the monitoring well.
2. Observe the wellhead for signs of deterioration. Record observations.
3. Identify the surveyed elevation point on the well. If one does not exist, create a mark using a steel file. This mark will be the measuring point for subsequent rounds of water level measurements.
4. Slowly lower the oil/water interface probe into the well.
5. When the oil/water interface probe contacts the light phase and air interface, note the point on the oil/water interface probe as referenced by the measuring point on the well.
6. Record the level to within 0.01 foot in the field notebook or gauging form.
7. Continue to lower the probe through the light phase layer. Record the depth to the water level in the field notebook.
8. Retrieve the oil/water interface probe and re-lock the well.
9. Decontaminate the oil/water interface probe after each use with a Alconox/distilled water wash followed by a distilled water rinse.

The disposable weighted cords will be cotton string with a stainless steel knot or washer. The disposable weighted cords will be lowered into the well to the water table and removed from the well to verify the presence of LNAPL. Upon retrieval the cords will be inspected for signs of LNAPL. The weighted cord will then be lowered to the bottom of the well and removed from the well to check for DNAPL. Decontamination will not be required as the weighted cords will be disposed after use.

2.6 GROUNDWATER SAMPLING PROCEDURES

Upon completion of the gauging event, all new wells and existing wells will be sampled. The upgradient and background wells will be purged and sampled before downgradient wells. Prior to purging a well, the presence or absence of NAPLs will be evaluated by using the procedures described in Section 2.5.2.

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;
- Peristaltic or Waterra Hydrolift-II pump;
- Pre-cleaned submersible pump with controls (bedrock well sampling);
- New or dedicated HDPE tubing;
- New or dedicated foot-valve;
- VOC sampling kit for Waterra pump;
- Personal protective equipment (PPE);
- Disposable gloves;
- Distilled/deionized water;
- Cleaning detergents for decontamination;
- 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.

2.6.1 Well Purging and Stabilization

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 hydrolift pumping equipment for well purging. 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. A minimum of three and a maximum of six well volumes will be purged from those wells that are not purged dry. A well volume is defined as the volume of water within the screen and riser. The volume of water in the well can be calculated using the following equation:

$$V \text{ (in cubic feet)} = \pi r^2 h$$

This equation simplifies the following equation, which uses the diameter of the well in inches and a constant to convert the volume to gallons.

$$V \text{ (in gallons)} = h \times d^2 \times 0.0408.$$

where:

V = volume of water in well;
π = 3.14;
h = height of the water column in the well in feet;
r = well radius in feet; and
d = well diameter in inches.

The depth to water will be measured to the nearest 0.01 foot. The total depth of the well will be determined from well installation logs or by sounding the depth of the well by lowering the water level indicator to the bottom of the well.

The pump inlet will be placed approximately at the center of the screened interval. The pump will be operated at a rate equal to or less than 2 gallons per minute (gpm). An attempt will be made to maintain a flow rate that results in minimal drawdown (less than 0.5 feet) and minimal turbidity. Once the pumping is started, the flow rate will be checked using a stopwatch and five-gallon bucket. Pumping will continue until three to five well volumes have been removed or until the well is purged dry.

During purging, the pH, conductivity, temperature, and turbidity of the water will be monitored continuously using a flow-through cell or equivalent meters. The field parameter values are displayed on a hand held monitor. Measurements will be recorded at least every five minutes on a groundwater sampling data sheet. The stabilization of temperature, pH, and specific conductance during purging increases confidence that samples are representative of the groundwater (Keely and Boateng, 1987).
Criteria for stabilization are as follows:

X Temperature does not vary by more than 2°C between three successive five minute readings.

X pH does not vary by more than 0.1 standard units between three five minute readings.

X Specific conductance does not vary by more than 10% between three five minute readings.

If all three parameters have stabilized after purging three well volumes, purging will be considered complete. If any parameter has not stabilized, purging will continue until all parameters stabilize or until six well volumes have been purged or the well is purged dry. If all parameters have not stabilized after five well volumes, the changes in parameters may represent migration of water of a different quality toward the well under the influence of purging. The conditions will be noted on the purge sheet and purging will be considered complete.

Turbidity measurements of the purge water will also be continuously monitored using a turbidity meter. An attempt will be made to stabilize the turbidity of the purge water from each well at a value of 50 nephelometric units (NTUs) or less, prior to sample collection. The turbidity will be controlled by decreasing the flow rate. If turbidity stabilizes above 50 NTUs at any given groundwater sampling location, this condition will be documented on the groundwater sampling data sheet.

If a flow-through cell is used then oxidation-reduction potential (ORP) and dissolved oxygen (DO) will also be continuously monitored during purging. Stabilization of these two field parameters will not be required prior to sampling a well. Calibration procedures for the flow-through cell equipment is provided in Appendix B.

2.6.2 Groundwater Sampling Procedures

This procedure describes steps involved in collecting groundwater samples using dedicated tubing and a hydrolift or peristaltic pump. The objectives of the activities covered by this procedure are to:

X 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. The groundwater samples will be collected using VOC sampling kits compatible with the Waterra hydrolift pump.

Containers used for VOC analysis will be filled first using bottom-filling, small diameter tubing designed for VOC sampling with the pump, which reduces air bubbles and minimizes agitation so as to prevent aeration. The pumping rate will be lowered while VOC vials are being filled. 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).

If a peristaltic pump is used, a foot-valve will be placed on the bottom of the tubing. When purging is complete, sampling containers (except VOCs) will be filled directly from the pump discharge line 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 pump will then be turned off and the HDPE tubing will be disconnected from the pump. The VOC sampling vial will be filled by raising the tubing (with a foot-valve) from the well head and allowing the water to gently flow into the vial. The vial will be immediately capped such that no headspace or bubbles are present in the vial. This procedure ensures that the sample is representative of the purged interval and minimizes the potential for volatilization of VOCs, which may occur as a result of the pumping mechanism in the peristaltic pump.

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 4EC 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 rinseate blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.10 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.

2.7 SURFACE WATER SAMPLING PROCEDURES

Surface water samples will be collected using the following procedures:

- 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.

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.

Quality assurance samples, including duplicates, equipment rinseate blanks, and trip blanks will be collected as necessary in accordance with the procedures described in Section 2.10 and the *QAPP*. The sample custody procedures for the surface water 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 surface water sampling record or field notebook. A copy of a field surface water sampling record is provided in Attachment A.

2.8 SEDIMENT SAMPLING PROCEDURES

Sediment samples will be collected (zero to six inches below ground surface) 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. 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 liners. The soft sediment will be probed to a depth of two feet. Field observations including the type of sediment, stainings, odors, and changes in material will be documented. Two sediment samples will be selected from each location for laboratory analysis. The samples will be collected from the zero to six inch and the six to 12 inch interval and submitted for laboratory analysis.

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 2.10 and the *QAPP*. Sampling equipment will be decontaminated following the procedures in Section 2.11. 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 SURFACE SOIL SAMPLING PROCEDURES

Surface soil samples (zero to two inches and zero to six inches below ground surface) will be collected using hand augers or stainless-steel trowels as presented in the *SRI Work Plan*.

Where vegetation is present, the surface soil samples will be collected from beneath the vegetative cover. Some or all of the following equipment will be used to collect surface soil samples:

- Field boring log sheet and field notebook;
- Photo-ionization detector (PID);
- Stainless-steel hand auger or trowel;
- 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.

The sample will be scooped up with trowel and put into the sample jars. If using a hand auger, the sample will be removed and placed from auger into the sample jars using a trowel. If the soil will be analyzed for 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 head-space in the containers. A second aliquot of soil will be immediately retained for head-space analysis using a PID. The remaining sample containers will then be filled (grab samples).

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.

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.

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 minimize the potential for 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 following the procedures in Section 2.11.

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 2.10 and the *QAPP*. The sample custody procedures for the surface soil samples are described in Section 3.0. 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. A copy of a field sampling record is provided in Attachment A.

2.10 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.

2.10.1 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 with fictitious sample identification following the format for field samples.

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 form 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.

2.10.2 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 AFB≅ 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 a ARB≅ followed by the six digit date (i.e.,: RBYYMMDD).

2.10.3 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:

- X Laboratory reagent water;
- X Sample containers;
- X Cross contamination in shipment;
- X Ambient air or contact with analytical instrumentation during preparation and analysis at the laboratory; and
- X 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 ATB≅ followed by the six digit date (i.e.,: TBYYMMDD).

2.11 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 biodegradeable 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 the rear of the manufacturing buildings. 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.

2.12 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= 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

This section describes the procedure for identifying each soil boring location, Hydropunch™ sampling location, oxide box sampling location, monitoring well location, sediment sampling location, surface water sampling location, and surface soil sampling location.

Each soil boring advanced using a conventional drill rig will be designated by a "SB." Each soil boring advanced using a Geoprobe will be designated by a "GP." A number will follow the "SB" or "GP" name to associate the boring with a specific location.

The Hydropunch™ sample locations will be designated by a "HP," followed by a number. The number will correspond to the of soil boring.
The oxide box sample location will be denoted as BOX-1.

The proposed well names for the overburden monitoring wells have been designated by a AOB.≅ followed by a number. The proposed well names for the bedrock monitoring wells have been designated by a “BR.” followed by a number.

The surface water sample locations will be denoted with a “SW,” followed by a number. The sediment sample locations will be denoted with ASED,≅ 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 an 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 BCSSXY02ZZ where:

BC = Geneva Border City MGP site;
SS = surface soil sample;
X = starting depth (inches) of sample interval;
Y = ending depth (inches) of sample interval;
02 = year sample collected (2002); 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 would be coded BCSS020215.

For each subsurface soil sample collected from a soil boring location will be identified using the following code BCSBXXYY02ZZ where:

BC = Geneva Border City MGP site;
SB = 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;
02 = year boring installed (2002); and
ZZ = the boring location number.

For example, a subsurface soil sample collected from 8-10 feet from soil boring SB-24 would be coded BCSB08100224.

Groundwater samples will be identified by using the following code BCG@##02ZZ where,

BC = Geneva Border City 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;
02 = year well was installed (2002); and
ZZ = well location number.

For example, groundwater samples to be collected from the proposed well BR-3 will be coded BCGDBR0203.

Each surface water sample will be identified using the following code BCSW--02ZZ where:

BC = Geneva Border City 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;
02 = year sample collected (2002); and
ZZ = the sample location number.

For example, a surface water sample collected from surface water sampling location SW-5 would be coded BCSW--0205.

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 4EC until delivered to the laboratory. Preservation requirements are provided in Table 1. The samples will be kept cool at 4EC 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 4EC, 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

A Compendium of Superfund Field Operation Methods, OSWER Directive 9355.0-14, December 1987, EPA/540/P-87/001, Office of Solid Waste and Emergency Response.

ASTM 1986 Annual Book of ASTM Standards, Section 4-Construction, Volume 04.08 Soil and Rock; Building Stones; Philadelphia, Pennsylvania.

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Herzog, B.L., Chou, Sheng-Fu J., Valkenburg, J.R., and Griffin, R.A., 1988. "Changes in Volatile Organic Chemical Concentrations after Purging Slowly Recovering Wells. "Ground Water Monitoring Review, vol. 8, no. 4, pp. 93-99.

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TABLE 1

SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

TYPE OF ANALYSIS	SAMPLE VOLUME/CONTAINER	PRESERVATION REQUIREMENTS	MAXIMUM HOLDING TIMES
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.
PAHs (EPA Method 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 6010/7470)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 6 months.
Acid Volatile Sulfide/Simultaneously Exractable Metals (EPA Method 6010)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze for most metals within six months. Sulfide analyze within 7 days.
Cyanide Total, Amenable (EPA 9012/335.3)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 14 days.
Weak and Dissociable Cyanide	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 14 days.
Total Phenols (EPA Method 9065/420.1)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 28 days.
TOC, Dissolved (EPA 415.2)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 28 days.
BTU (ASTM D240)	1-6oz. Glass jar, Teflon cap	Cool 4 ° C	Analyze within 28 days.
Ignitability (EPA 1010)	All of these parameters can be done on the same sample in one 32oz. Plastic container	Cool 4 ° C	Analyze immediately.
Corrosivity (SM16 203)			
Reactivity (SM 7.3.2.1.)			
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

TABLE 1

SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

TYPE OF ANALYSIS	SAMPLE VOLUME/CONTAINER	PRESERVATION REQUIREMENTS	MAXIMUM HOLDING TIMES
PAHs (EPA Method 8270	1 Liter Glass	Cool 4 ^{o}C	Extract within seven days; analyze within 40 days
PCBs (EPA Method 8082)	1 Liter Glass	Cool 4 ^{o}C	Extract within 14 days; analyze within 40 days
Metals (EPA Method 6010/7470)	32 oz., Plastic	HNO_3 to pH < 2	Analyze within 6 months.
Total Phenols (EPA Method 9065/420.1)	500 ml, Glass	H_2SO_4 to pH < 2	Analyze within 28 days.
Cyanide Total, Amenable (EPA 9012/335.3)	8 oz., Plastic	NaOH to pH > 12 0.6g ascorbic acid	Analyze within 28 days.
Weak and Dissociable Cyanide	8 oz., Plastic	NaOH to pH > 12 0.6g ascorbic acid	Analyze within 28 days.
Alkalinity (EPA 310.1)	4 oz., Glass	Cool 4 ^{o}C	Analyze within 14 days.
Chloride (EPA 9252/325.3)	32 oz., Plastic	Cool 4 ^{o}C	Analyze within 28 days.
TOC, Dissolved (EPA 415.2)	8 oz., Plastic	Cool 4 ^{o}C	Analyze within 28 days.
Nitrate (EPA 9200/353.1)	8 oz., Plastic	H_2SO_4 to pH < 2	Analyze within 48 hours.
Nitrite (EPA 1983/354.1)	32 oz., Plastic	Cool 4 ^{o}C	Analyze within 48 hours.
Sulfate (EPA 9038/375.4)	32 oz., Plastic	Cool 4 ^{o}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 ^{o}C	Field filter immediately, analyze within 6 months.
Ethane, Ethene, Methane (GC)	40 ml (2 per sample), Glass	Cool 4 ^{o}C	Analyze within 7 days.

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

TABLE 1

SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS

NYSEG - GENEVA-BORDER CITY
FORMER MGP FACILITY

TYPE OF ANALYSIS	SAMPLE VOLUME/CONTAINER	PRESERVATION REQUIREMENTS	MAXIMUM HOLDING TIMES

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

APPENDIX A

FORMS

APPENDIX B

FIELD EQUIPMENT MANUALS

APPENDIX C

BEDROCK CORING PROCEDURES

ATTACHMENT A
FORMS

LOCATION OF BORING

JOB NUMBER	CLIENT	LOCATION

DRILLING METHOD:

BORING NUMBER

SHEET OF

SAMPLING METHOD:

DRILLING	
START	FINISH
TIME	TIME
DATE	DATE

SURFACE CONDITIONS:

DATUM ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT SAMPLER	OVA			DEPTH IN FEET	SOIL GRAPH
					AUGER	SAMPLE	CUTTINGS		
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	

CHECKED BY ______

DATE ______

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	

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:	

URS

GROUNDWATER SAMPLING DATA SHEET
NYSEG - MECHANICVILLE

WELL NO: ________
Page 1 of ___

Field Personnel:

____

____

Date: ________ ________
Job No.: ________ ________
Location: ________ ________

Total Well Depth (from top of casing): ________ feet

Depth to Water Surface Before Purging (from top of casing): - ________ feet

Height of Water Column: a = ________ feet
Length of screen b = ________ feet

Lesser of a and b ________

Well Diameter (d): ________ inches   Gals per ft: (d² x 0.0408) x ________

Volume of Water Column Before Purging: = ________ gallons or ________ liters

Volume of Water Equal to two saturated screen volumes:
(Volume of Column by 2.0) (1 gallon = 3.785 liters) ________ gallons or ________ liters

Purging Method: Bladder Pump/Waterra Pump/Peristaltic Pump   Meter # ________

Time	Well Volumes (Gallons / Liters)	Depth to Water (feet)	SC (mmhos/cm or µmhos)	Temp. (°F or °C)	pH (SU)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity (NTU)

Total Volume of Water Purged: ________ gallons/liters

Sampling Data:
- Sampling Method: Bailer or Pump
- Depth of Pump intake or bailer: ________ feet
- Color: Odor: Sheen/Appearance:

Notes:

____

____

____

____

____

____

____

Fspupp xls/gw sample sheet

URS

GROUNDWATER SAMPLING DATA SHEET

NYSEG-MECHANICVILLE

WELL NO: ______

Page ___ of ___

Field Personnel

____

Date: ______________

Job No.: ______________

Location: NYSEG - Mechanicville

Time	Well Volumes (Gallons / Liters)	Depth to Water (feet)	SC (mmhos/cm or umhos)	Temp. (°F or °C)	pH (SU)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidi (NTU)

Total Volume of Water Purged: ______________ gallons/liters

Notes:

URS

MONITORING WELL COMPLETION RECORD

Project: ____________ Well No. ____________

Project No. and Location: ____________

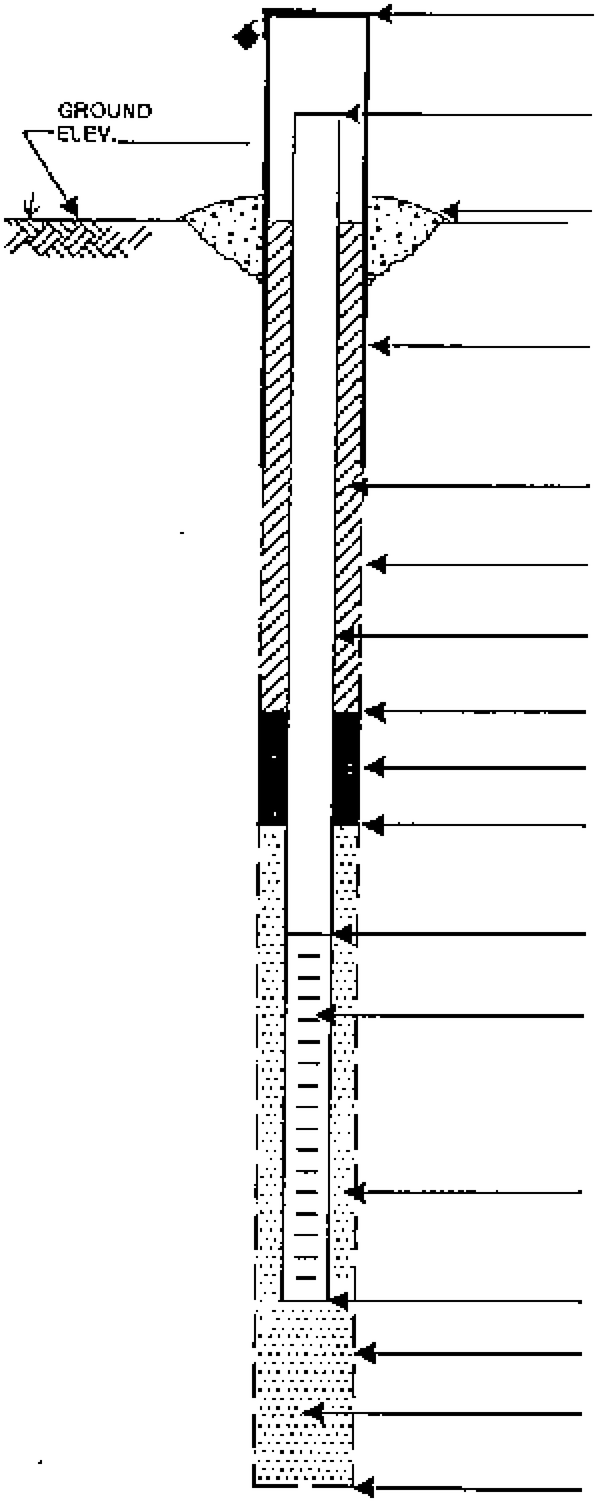
Installation Date(s): ____________

Field Geologist: ____________

Driller: ____________

Drilling Method: ____________

Development Method: ____________



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 : ____________

URS

WELL DEVELOPMENT RECORD

Project: ____________________

Project No. and Location: ____________________

Field Personnel: ____________________

Well No.: ____________________

Method(s) of Development: ____________________

DATE	WEATHER/ TEMP.	TIME	WATER DEPTH TOP OF RISER (FT)	pH (UNITS)	TEMP. (°C)	SP. COND. (umhos)	NTU	VISUAL APPEAR., ODOR, ETC...	NOTES : GAL. REMOVED, ETC...

NYSEG
Central Avenue Former MGP
Mechanicville, New York

WATER LEVEL MEASUREMENT SHEET

Date: ____________________

Measured By: ____________ Instrument: ____________________________

Well Number	Time	Depth to Water	LNAPL Observations	DNAPL Observations	Comments

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.

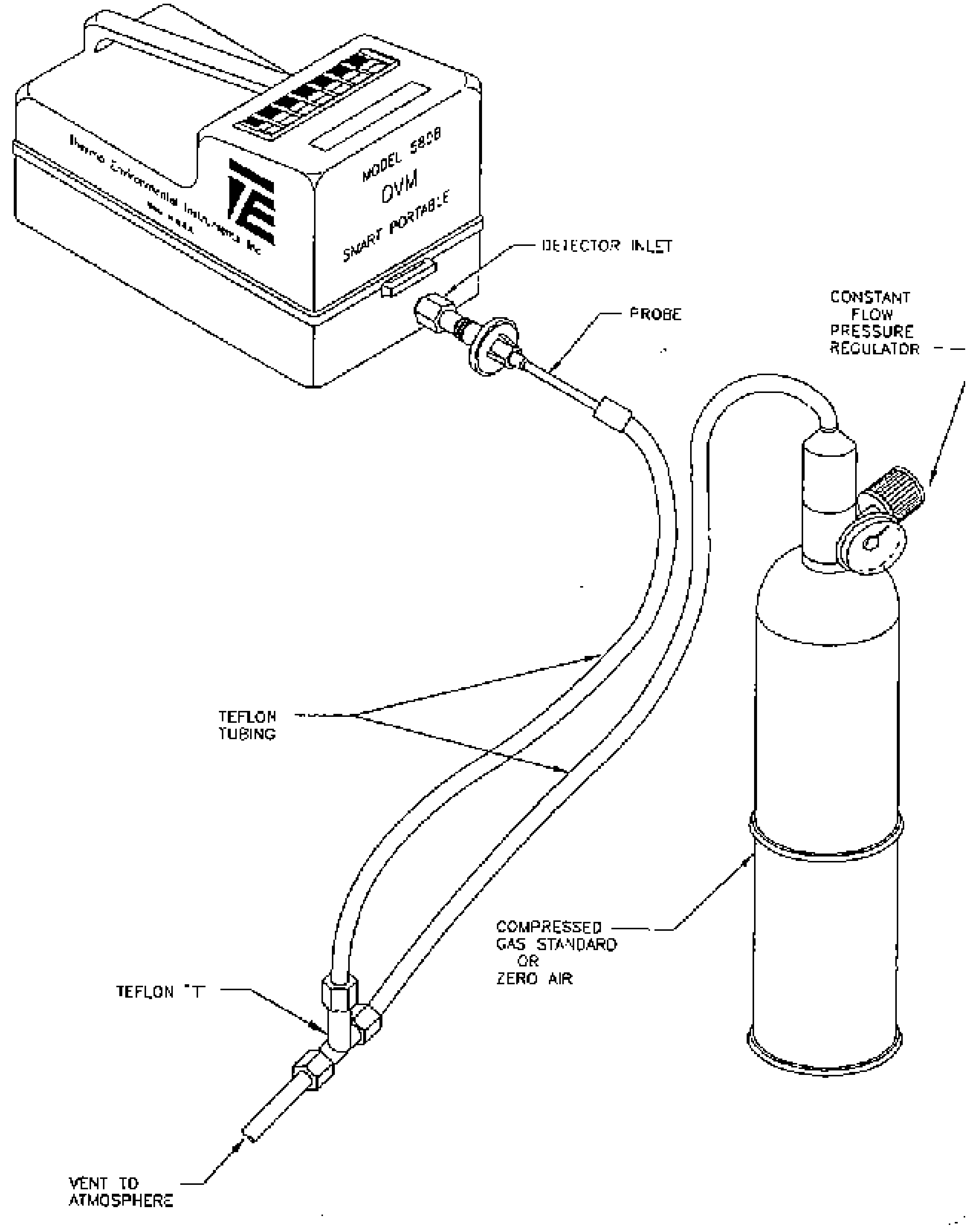


Figure 4.1
Cylinder Calibration

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.

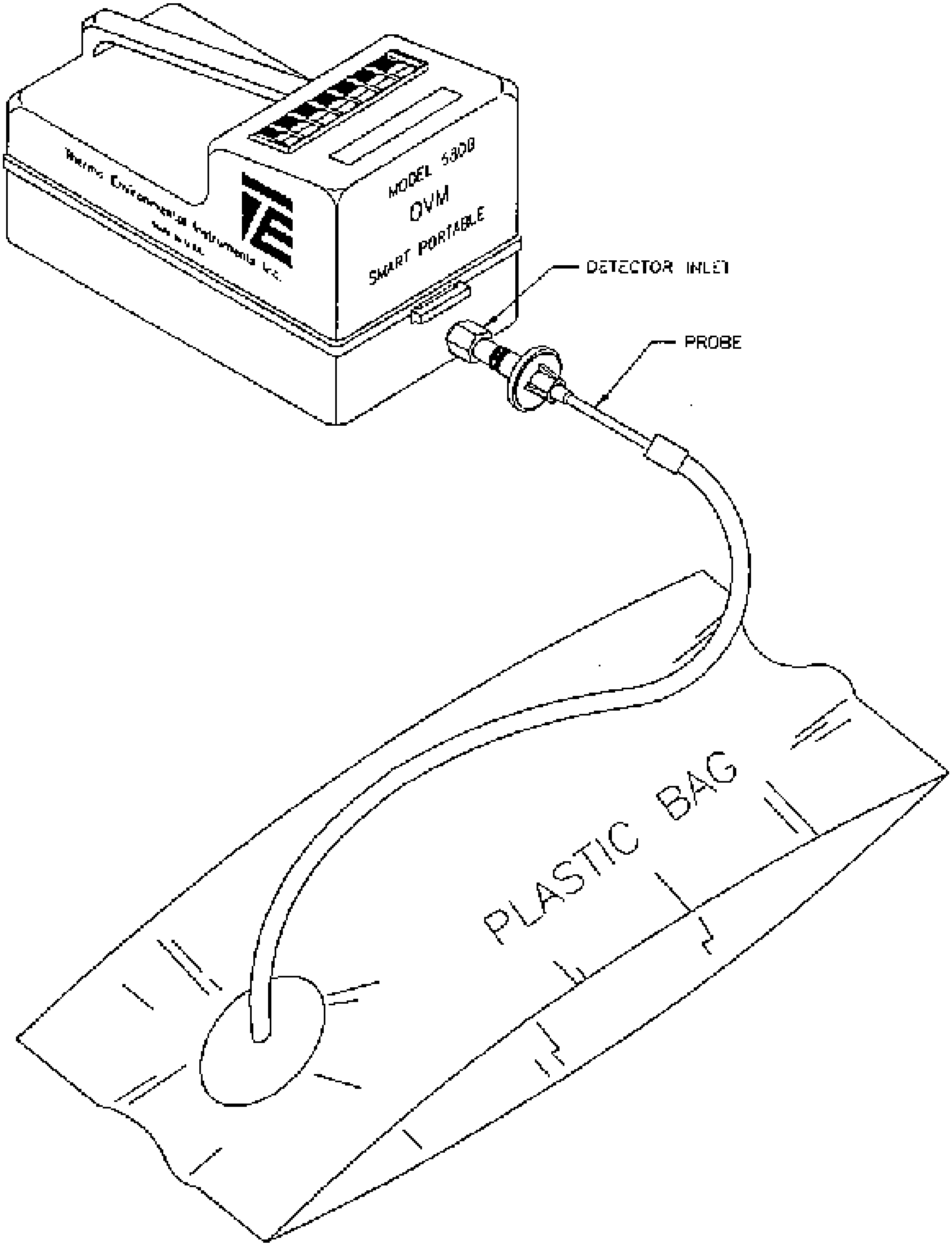


Figure 4.2
Bag Calibration

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:

$$\text{Conc (ppm by Vol)} = \frac{\text{1cc Isobutylene} \times 1000}{\text{10 L Air}} = 100 \text{ ppm}$$

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 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).

Then:

$$\text{Concentration (ppm by Volume)} = \frac{\text{Vapor Volume (ul)} \times 1000}{\text{Air Volume (liters)}}$$

The following is a sample calculation for benzene:

Liquid Volume = 2 ul

Benzene Density = 0.879 g/cc

Molecular Weight Benzene = 78.1

Air Volume = 10 Liters

$$\text{Vapor Volume} = \frac{2 \times 0.879 \times 24.45 = 0.55 \text{ ul}}{78.1} \quad \text{Benzene Vapor}$$

$$\text{Conc} = \frac{0.55 \times 1000}{10} = 55 \text{ ppm (vol)}$$

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 microliter 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:

$$\text{Response Factor (RF)} = \frac{\text{Factor STD Concentration}}{\text{580 Reading of Factor STD}}$$

$$RF = 55/91 = 0.604$$

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.

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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.

Solinst Water Level Meter: Operating Instructions

Models 101 & 102

Upon receipt of meter the following operational checks should be performed:

1. Set toggle switch to "on" or turn rotary dial fully clockwise.
2. Submerse 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 substanial submergence. Use of the P1, P2 or P3 probes to sound the bottom of the well may cause water ot 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) 661-2023
fax: (905) 873-1992

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From The Leader in Low Flow Sampling QED

MICROPURGE
Flow Cell
MODEL FC4000
User Guide

QED ***Environmental Systems, Inc.***
The GroundWater Specialists
P.O. 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
Rev #3 2-10-

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 valve 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

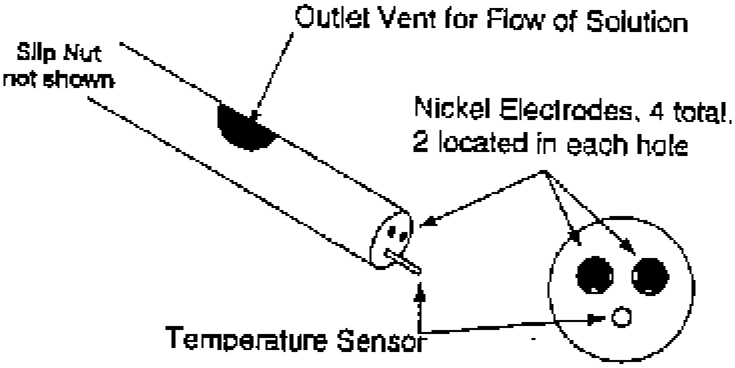


Figure 4.4 Temperature / Conductivity Probe

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 µS/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

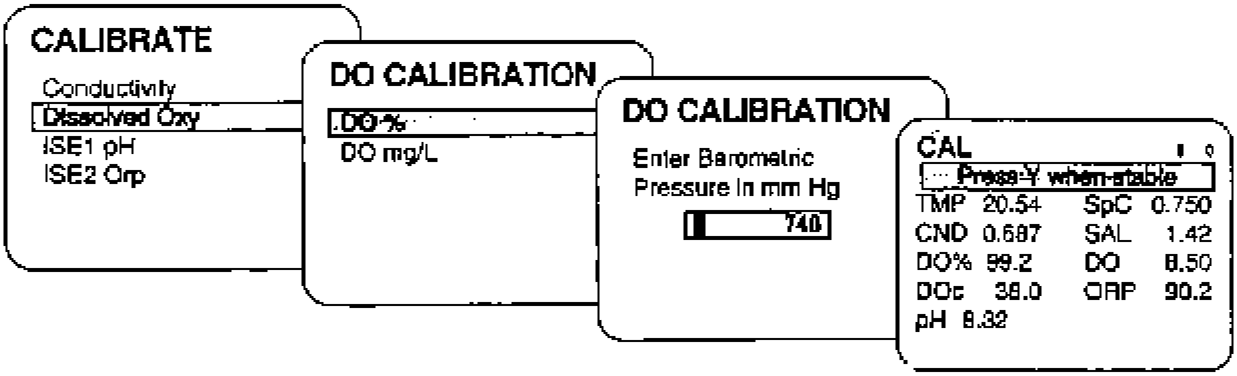
4.8.1 Calibration Notes

- 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 <u>not</u> 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.



TMP 20.54 SpC 0.750
CND 0.687 SAL 1.42
DO% 99.2 DO 8.50
DOc 38.0 ORP 90.2
pH 8.32

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.

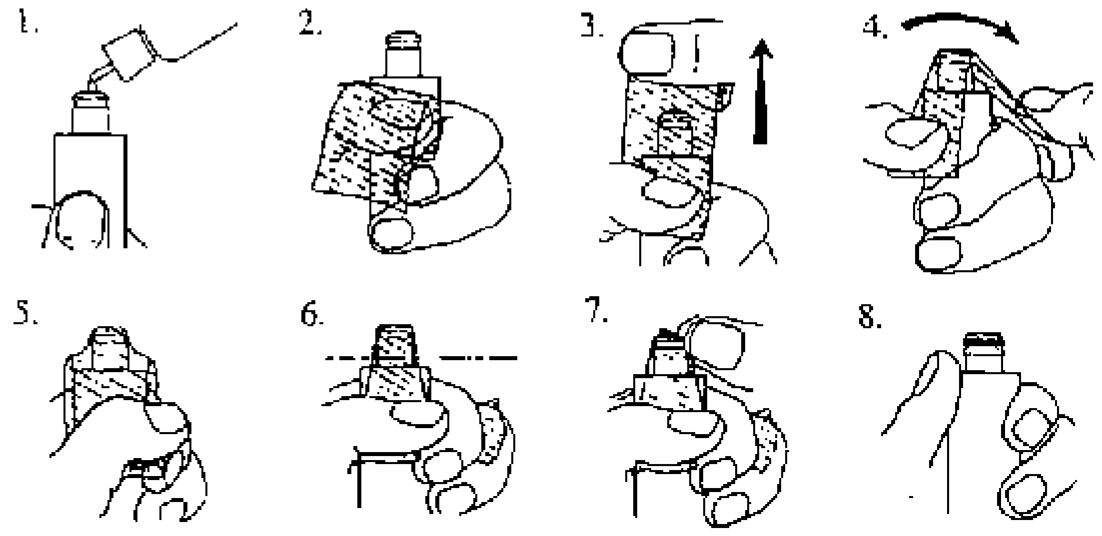


Figure 4.6 DO Membrane Replacement Procedure

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 regenerated.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).

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ATTACHMENT C
BEDROCK CORING PROCEDURES

Rock Coring

4.5 ROCK CORE BORINGS

4.5.1 Equipment and Techniques

Diamond drilling is the best means of obtaining samples in most rock materials. It is used in subsurface exploration for dams, tunnels, power plants on rock foundations, mineral deposits in rock and rock quarry materials. 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. Appendix A describes typical drilling equipment and coring device in detail. Figure 4-8 illustrates a typical rock core sampler.

4.5.2 Typical Problems in Rock Coring

4.5.2.1 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.

4.5.2.2 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.

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Fax # 518 786-1789	Fax #	

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.

4.5.2.3 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 pariculariy 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.

4.5.2.4 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.

4.5.2.5 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.

4.5.2.6 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 is 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.

4.5.3 Rock Core Handling and Shipping

The following guidelines should be followed in handling and shipping rock core.

4.5.3.1 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.

4.5.3.2 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. Figure 4-9 shows a properly filled core box.

4.5.3.3 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.L." (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.

4.5.3.4 Labeling Boxes

Core boxes are labeled on the top and inside of the lid and on the end faces (edges) as shown in Figure 4-9.

4.5.3.5 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.

4.5.3.6 Storage of Boxes

Core boxes are never left where they may be damaged or stolen.

4.5.3.7 Shipment of Boxes

If the boxes are shipped by common carrier, a Sample Shipment Form (paragraph 5.3.6) 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.

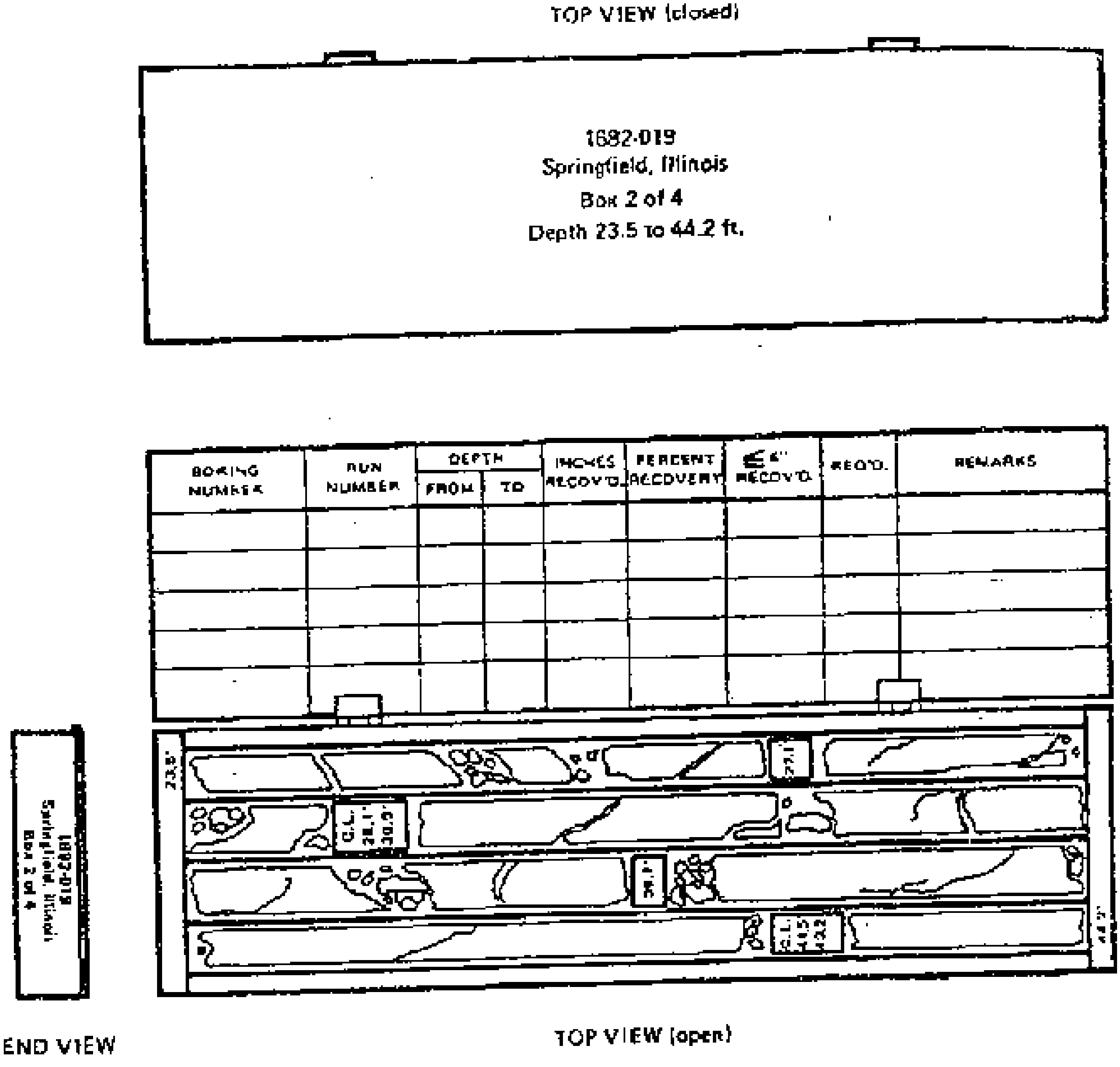

FIGURE 4-9. ARRANGEMENT OF ROCK CORE AND LABELING OF ROCK CORE BOXES

4.5.4 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 Dames & Moore 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 Dames & Moore 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 in a manner consistent with that described previously for soil sampling (Part 1 of Section 4.4.3).

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 Figure B-1, Appendix B, or in a similar fashion as dictated by the Project Manager or Principal Investigator.
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 log.

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.

RQD

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 4-7. 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 4-7, "partly weathered" is used for anything intermediate.

Table 4-2
Degree of Weathering

Term	Description
Fresh	The rock shows no discoloration loss of strength or any other effect of 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
Bedding Characteristics

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 zones of weathering or hydrothermal alteration. If a planar defect (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:

   a. Sequence of casing operations, including casing diameter and depth.

   b. 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.

   c. Bit drops or suspected voids.

   d. Gain, loss, color change, or change in consistency of the circulating fluid.

   e. Evidence of mineralization or oil and gas.

   f. Use of drilling mud or other fluid activities.

   g. Amount of cement used and depth interval of the setup cement if a hole has to be stabilized by cementing.

   h. Explanations for the probable cause of core losses.

ATION OF BORING	JOB NO	CLIENT	LOCATION

DRILLING METHOD

SAMPLING METHOD

BORING NO

SHEET 9 of

DRILLING

START TIME	FIN
DATE	DA

DRILLING CONTR.

No.54437

Rock Coring

DATUM

ELEVATION

SAMPLER TYPE		DEPTH OF CASING		BLOWS/FT SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH
Run #	Length of Core Recovered / Length of Core Run	Core Rec / Total Core Run	Total >4" Long / Total Core Run	Total >4" / Total Core Run			
RUN	REC / CORE	% REC	>4" / CORE	% RQD		25	
1	4.3 / 5.5	78	3.0 / 5.5	55		26	
	26.0' to 31.5'					27	
2	3.8 / 5.0	76	2.1 / 5.0	42		32	
	31.5' to 36.5'					33	
3	2.3 / 2.3	100	1.8 / 2.3	78		37	
	36.5' to 38.8'					38	

Run #1

Run #2

Run #3

RUN	REC / CORE	% REC	>4" / CORE	% RQD
Run Number	Length of Core Recovered / Total Length of Core Run	Core Recovered / Total Core Run	Total of >4" Rock Pcs. / Total Length of Run	Total >4" Pieces / Total Core Run

CHK'D BY

DATE

BY

TOTAL P.12