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FINAL

REVISED SITE INVESTIGATION WORK PLAN

- FOR THE -

Greenpoint Energy Center
Proposed Liquefaction Plant Replacement Area
Brooklyn, Kings County, New York

Submitted by:

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1.0 INTRODUCTION

Paulus Sokolowski & Sartor Engineering, PC (PS&SPC) has been retained by KeySpan Corporation (KeySpan) to prepare this Revised Site Investigation Work Plan (RSIWP) to document the methodologies to be followed in performing a site investigation of the soils and groundwater underlying the Proposed Liquefaction Plant Replacement Area (LPRA) of the Greenpoint Energy Center (see Figure 1 for Site Location Map). Figures 2 and 3 illustrate the portion of the LPRA to be investigated for the proposed LPRA. The objectives of the proposed LPRA site investigation are as follows:

1. To sufficiently characterize the proposed LPRA site soil and groundwater conditions in order to understand the nature and extent of environmental impacts; and
2. To provide the necessary information to support the removal of environmental impacts in the area of the proposed LPRA, proposed LNG Control Building Expansion, and associated substation, switchgears, and below-ground piping that may pose a hazard to human health during construction and operation of the facility.

In March 2004, thirteen (13) soil borings; GPE-1 through GPE-13, were installed in proximity to the LPRA in order to support a preliminary site investigation of this area. The soil borings were installed in accordance with the procedures outlined in this RSIWP. The results of this preliminary investigation are summarized in the June 2004 Draft Preliminary Site Investigation Report (DPSIR). The DPSIR was reviewed by the New York State Department of Conservation (NYSDEC) in June 2004. The conclusions reached in DPSIR are presented in Section 1.3 of this RSIWP.

This RSIWP has been prepared to complete the investigation of soil and groundwater at the site and to respond to NYSDEC comments on the DPSIR. The LPRA site is illustrated on Figure 2. As illustrated on Figure 3, thirteen (13) additional soil borings; GPE-14 through GPE-26, and ten (10) monitoring wells; MW-1S, MW-1D, MW-2S, MW-2D, MW-3S, MW-3D, MW-4S, MW-4D, MW-5S and MW-5D are proposed to be installed to determine if observed soil impacts have resulted in impacts to groundwater. Two test pits, TP-1 and TP-2, are proposed to be excavated in order to further assess subsurface soil conditions. Soil samples from the boring locations and groundwater samples from the monitoring wells will be collected and analyzed for the presence of significant or notable chemical constituents. In addition, the soil borings and monitoring wells will provide information regarding the groundwater table elevation.

1.1 Site Investigation Work Plan Objectives and Scope

The purpose of the RSIWP is to describe the methods and procedures to be implemented during the performance of the site investigation activities to be conducted at the proposed LPRA of the Greenpoint Energy Center. This work plan includes the following components:

- A discussion of the site location and its environmental setting;

- A discussion of the site investigation results;
- A discussion of the methods and procedures to implement the site investigation activities;
- A discussion of the health and safety procedures to be followed during the implementation of the site investigation activities; and,
- A discussion of the Quality Assurance Project Plan (QAPP) that will be utilized to ensure the integrity of the data resulting from the site investigation activities.

1.2 Background Information

1.2.1 Site Description

The Greenpoint Energy Center is located at the intersection of Vandervoort Avenue and Maspeth Avenue in the Greenpoint Section of Brooklyn, New York. The location of the Site is depicted on Figure 1. The Center is bound to the north by Lombardy Street, to the east by Newtown Creek, to the south by Maspeth Avenue and to the west by Vandervoort Avenue. The Proposed Liquefaction Replacement Plant Area is located in the northeastern corner of the Center in an area bound by Lombardy Street and Newtown Creek. The overall layout of the Greenpoint Energy Center is depicted on Figure 2. The location and overall layout of the proposed LPRA is depicted on Figure 2.

1.2.2 Historical Site Usage

The Greenpoint Energy Center functioned as a large manufactured gas plant (MGP) and byproduct coking operation from 1928 until 1952. In addition, it has served as a major energy center for New York City, including support services for gas operations and production of Liquefied Natural Gas and Synthetic Natural Gas.

Review of historical property maps (see Appendix A) indicates that structures related to the former MGP and associated operations have, over time, occupied most of the current Greenpoint Energy Center. However in the specific area of the LPRA, only one structure, a small oil unloading pump house at the intersection of Lombardy Street and Newtown Creek, has ever been identified.

1.2.3 Current Site Usage

Currently, KeySpan operates a Liquefied Natural Gas (LNG) Plant at Greenpoint, Brooklyn. The plant produces LNG by liquefying pipeline gas. The LNG is stored in 2 tanks (LNG Tank Nos. 1 and 2) and is regasified (vaporized) for delivery back into the local pipeline distribution system as required.

The LNG plant was constructed in 1968 with various additions over the years. Currently the plant has a liquefaction capacity of 5.9 million standard cubic feet per day (scfd), a vaporization capacity of 280 million scfd and a storage capacity of 1600 million scf. The proposed liquefaction plant replacement will include the construction of an extension (approximately 125 feet by 45 feet) to the existing Control Building; the construction of a new LNG Plant Area Building (approximately 110 feet by 75 feet); and the installation of approximately 500 linear feet of overhead piping.

1.3 Previous Investigation

A preliminary site investigation was performed in the area of the proposed LNG expansion in March 2004 and the results are presented in the June 2004 DPSIR. Thirteen geoprobe borings were installed as part of this investigation to determine the presence or absence of environmental impacts in the soils underlying the proposed Liquefaction Plant Replacement Area and their locations are illustrated on Figure 3.

The DPSIR includes the following conclusions based on the findings of the preliminary site investigation:

- Chemicals of concern (VOC and SVOC compounds, cadmium, mercury and selenium) at levels exceeding their respective SCGs, are limited in extent to the upper ten feet of the surface soils. The majority of these SCG exceedances are concentrated in the surface soils above the encountered groundwater table (less than 5 feet).
- There is no specific identifiable source area for the observed soil impacts within or beneath the proposed area of construction.
- The observed soil impacts do not appear to be related to any former activities in the study area, and appear more likely to be associated with the miscellaneous soil fill that was previously placed in the study area.
- The findings of this investigation have provided sufficient information to fully characterize the soil impacts in the area of proposed construction and no further delineation is required.

NYSDEC comments to the Preliminary Site Investigation Report were issued to KeySpan by means of a June 29, 2004 correspondence. Responses to these comments were prepared by KeySpan and issued to the NYSDEC via a July 19, 2004 response letter.

1.4 Site Investigation Work Plan Organization

This RSIWP is organized in accordance with the following sections:

- **Section 1.0 – INTRODUCTION**: This section provides a brief description of the location of the Site and the historical operations performed.

- **Section 2.0 – PHYSICAL AND ENVIRONMENTAL SETTING**: This section discusses the physical and environmental setting of the Site including information regarding topography, geology and hydrogeology of the Site.
- **Section 3.0 – SITE INVESTIGATION SCOPE OF WORK**: This section of the RSIWP summarizes the investigative actions to be performed at the Site as well as the procedural aspects of their implementation.
- **Section 4.0 – QUALITY ASSURANCE PROJECT PLAN**: This section presents a summary of the Quality Assurance Project Plan developed for the implementation of the investigative activities to ensure the integrity of the resulting data.
- **Section 5.0 – HEALTH AND SAFETY PLAN**: This section of the RSIWP summarizes the health and safety measures to be taken in order to ensure worker safety during the implementation of the investigation activities.
- **Section 6.0 – SITE INVESTIGATION REPORT**: This section of the RSIWP presents details on the proposed report outline for the presentation of the results of all the investigation activities performed as described herein.

2.0 PHYSICAL AND ENVIRONMENTAL SETTING

2.1 Physical Setting

The Greenpoint Energy Center is located in the Greenpoint Section of Brooklyn, New York. Surrounding uses of the site are dominated by industrial and commercial uses with the exception to a residential area near Beadel Street to the northwest of the Site. To the north of the Site (along Lombardy Street) are commercial enterprises (i.e., a trucking company, a construction and demolition debris recycling plant and a solid waste transfer facility).

The proposed LPRA is separated into two areas: (1) the Proposed LNG Control Building Expansion and (2) the Proposed LNG Plant, including one substation and two switchgear areas. The Proposed LNG Control Building Expansion is located to the west of the Proposed LNG Plant. Both areas are relatively flat with a slight slope to the east towards Newtown Creek. The two areas are separated by a steep slope (i.e., on the order of 1H:1V). The slope is stabilized with a fiberglass mat covered with a black tar emulsion. The mat and the tar emulsion provide a suitable substrate for the control of vegetative growth and are also flame resistant.

2.2 Geology

Regional geology consists of fill material ranging in thickness from zero to several feet. The fill material consists of granular soils with varying amounts of miscellaneous debris. The fill material is underlain by a relatively narrow sequence of unconsolidated sediments of Quaternary age consisting of glacial moraine and glacial outwash sediments. These glacial sediments are further refined by four lithologic units: Glacial Till consisting of sand, gravel and cobbles and varying in thickness from 10 to 20 feet; Stratified sands and gravel varying in thickness from 100 to 200 feet; Thinly-bedded clay and silt lenses (Gardiners Clay) varying in thickness from 10 to 100 feet but absent in most places; and, stratified sand and gravel Costal Plain sediments varying in thickness from 30 to 60 feet. According to published literature, bedrock exists at approximately 50 to 150 feet below grade and underlies the Coastal Plain sediment and consists of massive to gneissic granitic rock.

Subsurface conditions in the site area are expected to be generally consistent with regional geology and to typically include the following soil strata, in order of increasing depth:

- Little to several feet (4 to 6 feet) of surficial fill materials;
- Organic silt/peat (may or may not be encountered beneath the Site);
- Glacial outwash or lacustrine deposits; and,
- Glacial moraine/drift soils.

2.3 Hydrogeology

There are no surface water bodies located on the Site. Newtown Creek borders the Site to the east. The groundwater flow beneath the Site is controlled by Newtown Creek and groundwater flow across the Site is in an easterly direction toward Newtown Creek.

3.0 REVISED SITE INVESTIGATION SCOPE OF WORK

In general, the revised site investigation is proposed to include the installation of thirteen (13) additional soil borings, two (2) test pits and ten (10) groundwater monitoring wells to determine the nature and extent of soil and groundwater impacts.

The following tasks comprise the Scope of Work:

- Field Investigation Preparation;
- Site Mobilization Activities;
- Decontamination Area and Waste Storage Area
- Field investigation activities including the installation of soil borings, groundwater monitoring wells and the collection of soil and groundwater samples from the borings and monitoring wells;
- Air monitoring activities;
- Laboratory analysis of the soil and groundwater samples;
- Data reduction and summary;
- Preparation of summary report; and,
- Presentation of findings.

The proposed soil boring and test pit locations are depicted on Figure 3 and were selected to further delineate the extent of impacted soils within the LPRA. The proposed monitoring well locations, also depicted on Figure 3, were selected based on the results of the preliminary site investigation in order to obtain groundwater data upgradient and downgradient of the proposed LPRA.

Descriptions of each activity comprising the Scope of Work are presented in the following subsections.

3.1 Field Investigation Preparation

Prior to mobilization to the Site, KeySpan will field locate, survey, and use Keyspan personnel to identify all potential utility impacts for all proposed soil boring and groundwater monitoring well locations. Prior to mobilization to the Site, the drilling subcontractor will also contact the New York Underground Facilities Protective Organization (UFPO) to obtain a utility markout of the Site. In addition, all locations will be cleared by manual-digging or vacuum extraction using a "Guzzler" type equipment to a depth of 5 feet below ground surface to rule out potential utility conflicts.

3.2 Site Mobilization Activities

Upon approval of the Work Plan by the NYSDEC and authorization from KeySpan, PS&S will mobilize to the site and prepare for the field investigation program. A field

operations center will be set up on the site in a mobile van, construction trailer or designated area at the LNG Facility.

3.3 Decontamination Area and Waste Storage Area

Immediately upon mobilization to the Site, a decontamination station will be constructed by the Drilling Subcontractor. The decontamination station will consist of a plastic lined, bermed area that will contain and allow for the collection of all decontamination fluids. Decontamination activities for hand tools and sampling equipment may also be conducted in a portable decontamination container (i.e., 55-gallon United States Department of Transportation (USDOT) specification drum). The location of the decontamination area will be selected in the field in conjunction with facility personnel. During the investigation, the MacroCore shoe, drilling point and barrel will be decontaminated between each soil boring as per the Site-Specific Health and Safety Plan (HASP) and the Quality Assurance Project Plan (QAPP).

Investigative derived wastes including drill cuttings, groundwater, decontamination waters and PPE will be collected and stored within 55-gallon USDOT drums at the established waste storage area. The drums will be placed on a plastic lined, bermed waste storage area. The location of the waste storage area will be decided during the preliminary site visit to be completed prior to the start of the field investigation. KeySpan will characterize and arrange for the off-site disposal of all investigation derived wastes (IDW).

3.4 Soil Investigation

3.4.1 Installation of Soil Borings and Test Pits

The additional soil borings (GPE-14 through GPE-26) will be installed at locations indicated on Figure 3. The soil borings will be advanced to a depth corresponding with an anticipated layer of glacial lacustrine deposits. These deposits are expected to be encountered approximately 50 feet below grade surface (bgs). Each soil boring will be advanced a minimum of one foot and a maximum of two feet into the glacial lacustrine deposits. If the lacustrine deposits are not encountered, the boring will be extended nominally to 50 feet bgs or a minimum of 10 feet into visibly un-impacted soils, whichever is greater.

The first five (5) feet of all soil borings are to be advanced by manual and vacuum excavation methods in accordance with facility procedures. These methods include manual digging with electrically insulated shovels and hand tools, and vacuum excavation with a Guzzler-type supersucker.

In order to assess the potential for odor emissions during excavation activities, two (2) test pits are proposed to be excavated as part of the proposed site

investigation activities utilizing manual and vacuum removal methods. The location of the first test pit (TP-1) is shown on Figure 3. The second test pit (TP-2) will be located in the field and will be biased toward the soil boring utility clearance excavation that exhibits the greatest amount of impact to surficial soils. The test pits will be excavated by expanding the required utility clearance excavation by two (2) feet and monitoring the open test pit for organic vapor generated both during and after the excavation. This data will be used to evaluate potential remedial efforts to be conducted at the proposed LPRA.

The soil borings will be installed via direct push methods utilizing a GeoProbe® drill rig. The direct push installation method will allow for the relatively rapid collection of soil samples with minimal disturbance of the ground surface and the generation of a minimal amount of soil cuttings that will require containerization, characterization and off-site disposal. The direct push installation methods will utilize the closed-piston-MacroCore configuration for each sample collected after the first five-foot interval.

The entire depth of the soil column will be logged per the Unified Soil Classification System (U.S.C.S.). Field screening will include physical observations (visual and olfactory) as well as the use of field screening methodologies including but not limited to the use of properly calibrated photo or flame ionization detectors (PID/FID). These field screening methodologies will include a headspace sample collected in a driller's jar or sealed plastic bag at least every two feet. The sample will be allowed to equilibrate and warm up for at least ten minutes before analyzing the headspace with a PID/FID. This information as well as the soil stratigraphy will be documented on Soil Boring Logs. All field screening instruments (PIDs, FIDs, etc.) will be calibrated daily and documented as per the requirements of the QAPP.

3.4.2 Collection of Soil Samples

Soil samples will be obtained from the soil borings at the following depth intervals:

- Surficial interval of each soil boring (i.e., 0.5 to 2.0 feet bgs). The surficial sample will be collected via manual sampling equipment during the manual/vacuum clearing of each borehole;
- The six-inch interval above the encountered groundwater table;
- The interval exhibiting the greatest indications of contamination based on field screening, olfactory and visual indications of contamination; and,
- The "visibly clean" zone located beneath the deepest interval of observed impacts. If impacts are noted to a depth corresponding with the terminal depth of the boring, the soil sample will be obtained at the terminal depth of the boring.

All sampling as well as storage, management and transportation of samples will be performed in accordance with all applicable federal, state and local regulations. Soil samples will be stored in coolers packed with ice and maintained at a temperature less than or equal to four degrees Celsius (4° C). Soil samples will be transferred to H2M Laboratories, Inc. of Melville, New York, a laboratory certified in the State of New York (Certification Number 10478), along with a properly completed Chain-of-Custody.

Following completion of the boreholes and the collection of soil samples, the boreholes will be grouted to the surface utilizing a cement-bentonite grout and finished to match pre-disturbance grades. All soil boring installation and sampling equipment will be decontaminated as per the requirements of the QAPP.

3.4.3 Quality Assurance/Quality Control (QA/QC) Samples (Soils)

Quality Assurance/Quality Control (QA/QC) samples for the soil investigation will be collected to ensure the integrity of the resulting analytical laboratory data. The QA/QC samples will include blind duplicate soil samples, matrix spike/matrix spike duplicate (MS/MSD) samples, and equipment rinsate blank samples. The quality control samples will be completed at a frequency of one set of QA/QC samples for every twenty (20) field samples or one per week of sampling, whichever is more frequent.

3.4.4 Laboratory Analysis (Soil)

All of the collected soil samples and associated quality control/quality assurance control blanks will be analyzed for the following parameters at H2M Laboratories (certified in the State of New York to perform these analyses):

- Target Compound List (TCL) Volatile Organic Compounds (VOCs);
- TCL Semi-Volatile Organic Compounds (SVOCs);
- Polychlorinated Biphenyls (PCBs);
- Cyanide; and,
- Resource Conservation Recovery Act (RCRA) Metals.

3.4.5 Groundwater Investigation

The following sections of this RSIWP document the procedures to be followed to install, purge and develop the monitoring wells as well as to collect the groundwater samples and transfer the samples to H2M Laboratories, Inc.

3.4.6 Installation of Monitoring Wells

A total of ten (10) monitoring wells will be installed at locations identified on the attached Figure 3. The wells will be installed in five clusters (MW-1, MW-2, MW-3, MW-4, and MW-5) with each cluster having a well screened at a shallow (identified with an "S") and a deep (identified with a "D") depth interval. The MW-1 and MW-5 clusters are being installed to assess the quality of the groundwater flowing onto the Site (i.e., background conditions). Based on the results of the soil samples obtained from the previously installed soil borings, water table information and the proposed locations of the MW-1 and MW-5 clusters (i.e., situated topographically higher than the surrounding area), MW-1S and MW-5S will both be screened at an estimated interval of 16 to 26 feet bgs; MW-1D and MW-5D will be screened at an estimated interval of 45 to 55 feet bgs.

Monitoring well clusters MW-2, MW3, and MW4 are being installed to assess the groundwater conditions downgradient of the proposed LPRA. The shallow (S) wells in each cluster will be screened at an estimated interval of 2 to 12 feet bgs and the deep (D) wells in each cluster will be screened at an estimated interval of 30 to 40 feet bgs.

The shallow monitoring wells will be installed with a hollow-stem auger using an inner diameter (I.D.) 4.25-inch auger. The groundwater monitoring wells will be constructed of threaded, two (2)-inch diameter, Schedule 40 polyvinyl chloride (PVC) well casing equipped with 20-slot well screen. A two-foot sump (solid PVC casing) will be attached to the bottom of the well screen to aid in the collection of dense non-aqueous phase liquid (DNAPL). The well screen will extend nominally to eight (8) feet below the water table with a minimum of two (2) feet of well screen situated above the top of the water table totaling ten (10) feet of well screen. The screen intervals will be verified during the soil boring program and will be adjusted, as needed, depending on field conditions. The length of well screen extending above the top of the water table will also be determined based on field conditions. No. 1 sand will be placed in the annular space around the well casing from one (1) foot below the screened interval extending to a minimum of two (2) feet above the top of the well screen. The annular space for the filter pack will be between two (2) and four (4)-inches thick. A two (2)-foot bentonite seal will be placed above the sand pack and wetted with potable water for a minimum of 15 minutes prior to backfilling the remaining space with a cement-bentonite grout mixture. If warranted, due to the depth of the deep wells (i.e., 45 feet bgs), backfilling will be completed using a tremie pipe placed below the surface of the grout mixture. A well construction diagram (Well Log) will be developed to document the construction of each well.

A solid PVC riser will be attached to the well screen and extended to correspond with the approximate surface grade. A lockable, water-tight cap will be installed and the well finished with either a flush-mount or above-grade protective casing. A measuring point (e.g., a notch carved in the casing or marking with indelible ink) will be installed at each well location to allow for consistent water level measurements. The measuring point will be surveyed to ensure that the water level measurements are comparable between each well location.

The deep monitoring wells will be constructed in a similar manner. The final screen intervals will be based on field observations noted during the soil boring program.

3.4.7 Monitoring Well Development

The monitoring wells will be developed prior to taking groundwater level/product measurements and collecting samples. Development of the wells will be performed by alternately surging and pumping the wells, utilizing a submersible pump, until the development water achieves 50 NTUs, to the extent feasible or until stabilization of pH, conductivity, temperature, and dissolved oxygen is achieved. However, if neither of the two parameters can be reasonably achieved within an approximate two-hour time frame, well development will be deemed complete. A properly calibrated turbidity meter will be used to monitor the NTU levels. Field measurements for pH, conductivity, temperature and dissolved oxygen will be recorded in the Log Book during the development activities.

Development water generated during well development activities will be containerized in USDOT-approved 55-gallon drums. The drums will be staged on-site, characterized and disposed of at an off-site disposal facility. All equipment utilized for the development of the monitoring wells will be decontaminated prior to use and between wells in accordance with the Site Specific Health and Safety Plan (Appendix C).

3.4.8 Water Level and Product Measurements

After the wells have been allowed to recharge and stabilize for a minimum of two (2) weeks, the wells will be accessed and synoptic water and product measurements (non-aqueous phase liquids (NAPL)), if any, will be obtained. All measurements will be made utilizing the measurement point established at each well location. The water and product measurement will be made with a properly calibrated oil/water interface probe. If NAPL is measured on the oil/water interface probe, a weighted cotton string will be utilized to confirm the presence of any NAPL measured. A disposable bailer will be used to determine if the NAPL exists as an emulsion or as a solid layer(s). The static water level will be

measured to the nearest 0.01 foot. The oil/water interface probe will be decontaminated between each well location.

3.4.9 Groundwater Sampling

After a minimum of two weeks following the completion of the well development activities, groundwater samples will be collected from the ten (10) monitoring wells.

Following initial access to the well, a measurement of the total well depth, the depth to groundwater and depth and thickness of product, if any, will be obtained. If substantial product accumulation is present in any of the wells, the product will be removed, via hand bailing and containerized. No groundwater samples will be obtained from wells that contain significant accumulations of product.

Groundwater purging and sampling of the monitoring wells will be conducted in accordance with the procedures set forth in "Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells", published July 30, 1996. The wells will be purged and sampled at rates that minimize or eliminate significant drawdown. A purging/sampling submersible pump (e.g., Grundfos pump with a flow controller box) with dedicated polyethylene tubing, as practical, will be used at each well. Water quality will be monitored for pH, temperature, specific conductivity, oxidation-reduction potential (Eh), dissolved oxygen and turbidity using an inline water quality meter with flow through cell. The tubing volume will be calculated and, upon removal of one tubing volume of groundwater, water quality parameters will be recorded at five (5)-minute intervals to determine the stability of the well. Stability will be considered to have been achieved when pH is within 0.1 standard unit, temperature is within 0.5°C, Eh is within +/- 10 millivolts, turbidity is within 10% for values greater than 1, DO is within 10%, and specific conductivity is within 3% for three consecutive readings.

When stability is attained, samples will be collected from each of the monitoring wells. Samples will be collected directly through the dedicated tubing and the purging/sampling pump prior to entering the flow through cell thereby ensuring a representative sample of aquifer conditions. Groundwater samples will be placed directly into pre-cleaned and appropriately preserved sample containers provided by the selected analytical laboratory. Once filled, the groundwater samples will be placed into a cooler and maintained at a temperature of 4°C or less.

3.4.10 Equipment Decontamination

Prior to sampling, all non-dedicated/non-disposable equipment (i.e., pumps, bowls, spoons, and bailers) will be washed with potable water and a laboratory

grade detergent (such as Alconox). Decontamination may take place at the sampling location as long as all liquids are containerized. The sampling equipment will then be rinsed with potable water followed by a reagent-grade isopropanol rinse and finally a deionized water rinse. Additionally, all equipment used to collect samples for metals analysis will receive a nitric acid rinse followed by a deionized water rinse. Between rinses, equipment will be placed on polyethylene sheeting. At no time will decontaminated equipment be placed directly on the ground. Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

3.4.11 Quality Assurance/Quality Control (QA/QC) Samples

In addition to the collection of groundwater samples, quality assurance/quality control (QA/QC) samples will be collected at the following frequency:

- One (1) trip blank sample will be prepared for each day of groundwater sampling;
- One blind duplicate sample will be collected for every twenty (20) groundwater samples or for every week of sampling, whichever is more frequent;
- One equipment rinsate sample will be collected for every twenty (20) groundwater samples collected or for every week of sampling, whichever is more frequent; and,
- One matrix spike/matrix spike duplicate (MS/MSD) sample will be collected for every twenty (20) groundwater samples collected or for every week of sampling, whichever is more frequent.

Each QA/QC sample, with the exception of the trip blank sample, will be analyzed for the same parameters as the soil and groundwater samples with the exception of the trip blank. The trip blank samples (groundwater only) will be analyzed for TCL Volatile Organic Compounds (VOCs) only.

3.4.12 Laboratory Analysis (Groundwater)

All of the collected groundwater samples and associated quality control/quality assurance control blanks will be analyzed for the following parameters at H2M Laboratories:

- Target Compound List (TCL) Volatile Organic Compounds (VOCs);
- TCL Semi-Volatile Organic Compounds (SVOCs);
- Polychlorinated Biphenyls (PCBs);
- Cyanide; and,
- Resource Conservation Recovery Act (RCRA) Metals.

3.5 Air Monitoring

In accordance with NYSDEC and New York State Department of Health (NYSDOH), a Community Air Monitoring Plan (CAMP) will be implemented at the Site during the performance of intrusive field activities. The requirements for the CAMP are included in the Site-Specific Health and Safety Plan (see Appendix C). Air monitoring stations will be located up and down-wind of each boring location. Volatile organic compounds (VOCs) and respirable particulates (PM-10) will be monitored at the stations on a continuous basis. Wind direction will be determined using a wind sock(s) and/or flagging poles installed on-site.

Breathing-zone monitoring will be conducted utilizing hand-held equipment to monitor VOCs, particulates, and cyanide in the work area. VOCs, particulates, and cyanide will also be monitored around the perimeter of the work zone on a regular basis by the field personnel. The VOC monitoring, response levels and actions are presented in the Site-Specific Health and Safety Plan included in Appendix C of this work plan.

4.0 QUALITY ASSURANCE PROJECT PLAN

All analytical data will be provided as New York State Category B data deliverables. The data will be validated in accordance with NYASP protocols. The data validator will prepare a data usability summary report discussing the adequacy of the analytical data obtained from the laboratory and any pertinent data excursions or limitations on the use of the data. The Data Usability Summary Report (DUSR) will be utilized in preparing the Site Investigation Report and will be submitted as part of the Site Investigation Report. A copy of the Quality Assurance Project Plan is included as Appendix B.

The data validation process will ensure that the data collected and reported by the laboratory are of sufficient quality that management decisions regarding the degree and extent of potential impacts can be readily decided. The data validation will evaluate whether the required quantitation limits have been achieved for each sample analyzed, and will evaluate the precision, accuracy and completeness of the data. The data validator will use the blind duplicate samples, the MS/MSD samples, the trip blanks, spikes and other standards to assess the quality of the data obtained. Any deviations from the required level of sample quality will be called out in the data usability summary reports prepared by the data validator and these deviations will be taken into consideration when using the data to explain site conditions.

5.0 SITE SPECIFIC HEALTH AND SAFETY PLAN

All work will be performed in accordance with OSHA, state, and industry safety standards and the Site-Specific Health and Safety Plan (see Appendix C). All work at the Site is expected to be performed using Level D personal protective equipment.

All air monitoring equipment will be calibrated and maintained in accordance with the Site-Specific Health and Safety Plan. During the installation of borings and monitoring wells and the collection of soil and groundwater samples, organic vapor concentrations within the work area shall be measured continuously. During any other activities that may generate organic vapors, monitoring shall be conducted at least once every thirty minutes. Organic vapor concentrations shall be measured upwind of the work site to determine background concentrations at least twice a day, (once in the morning and once in the afternoon).

6.0 REVISED SITE INVESTIGATION REPORT PREPARATION

6.1 Data Reduction and Data Summary

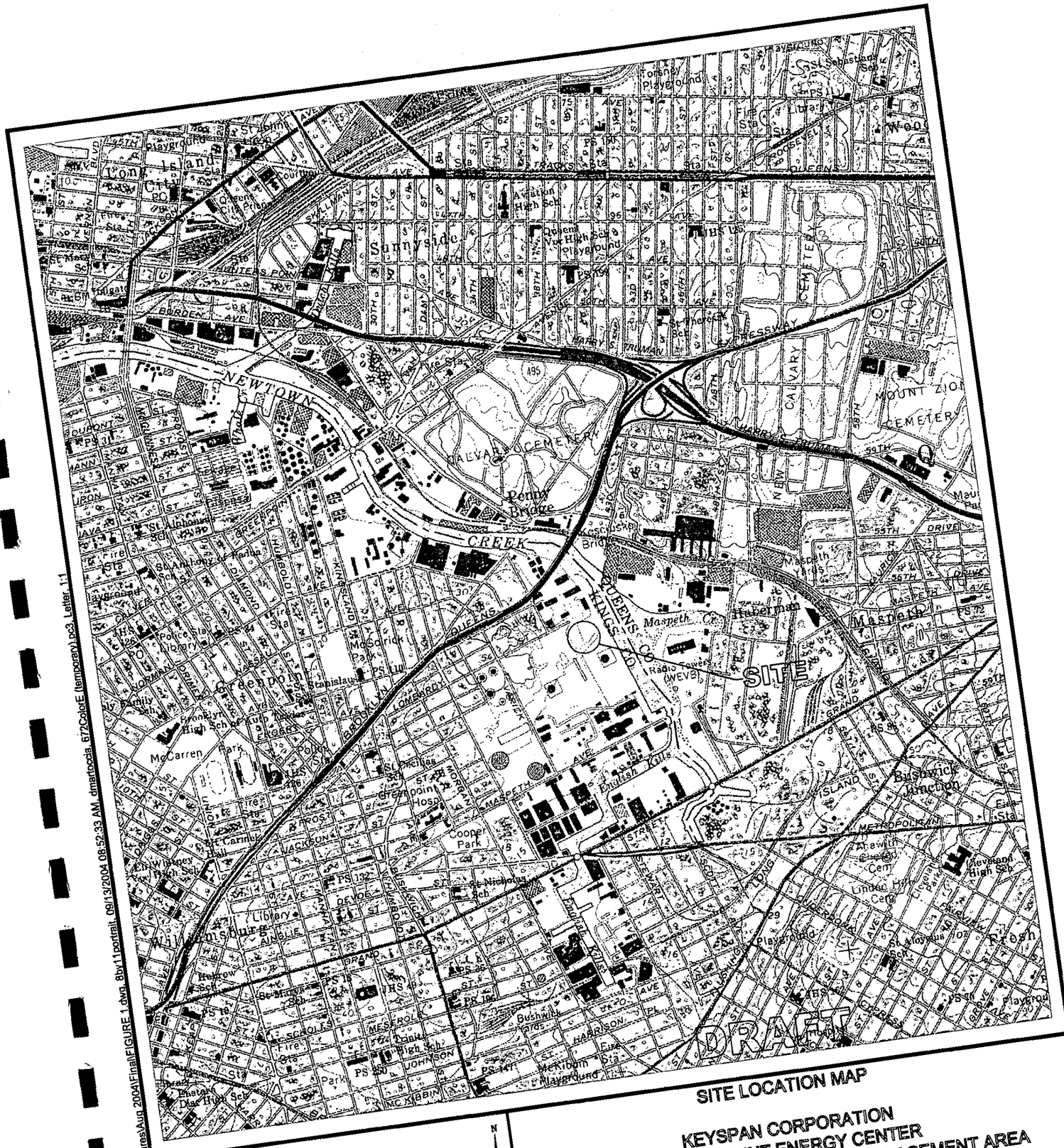
Field observations and empirical data collected during the preliminary and additional site investigations will be analyzed to prepare a site conceptual model. A composite base map, including all sample locations, will be developed. Analytical data will be validated to determine if the data meets acceptable criteria for precision, accuracy and completeness. Validated analytical data will be tabulated and compared to applicable NYSDEC Recommended Soil Cleanup Objectives as detailed in Technical and Administrative Guidance Memorandum (TAGM) #4046 as well as the "Surface Water and Groundwater Quality Standards and Effluent Limitations" as listed in 6NYCRR Part 703 and supplemented by the values listed in the "Ambient Water Quality Standards and Guidance Values" as listed in the Technical and Operational Series (TOGS) 1.1.1 (as applicable).

6.2 Site Investigation Report

Data collected, as part of this supplemental investigation, will be incorporated into the Site Investigation Report which will include:

- Description of the site investigation activities;
- Discussion of site geology and hydrogeology;
- Discussion of identified contaminants and their concentrations in soils and groundwater;
- Discussion of the comparison of soil and groundwater analytical data to the NYSDEC Recommended Soil Cleanup Objectives as detailed in TAGM #4046 as well as the Groundwater Quality Standards established in 6NYCRR Part 703 and TOGS 1.1.1 (as applicable);
- Identification of areas that exceed applicable soil and groundwater standards;
- Results of air monitoring activities;
- Detailed boring and well logs;
- Detailed well sampling logs noting the results of field measurements (i.e., pH, specific conductivity, temperature, oxidation-reduction potential, obtained during the sampling
- Data usability summary reports;
- Validated laboratory reports; and
- Recommendations and Conclusions

FIGURES



SITE LOCATION MAP

KEYSPAN CORPORATION
GREENPOINT ENERGY CENTER
PROPOSED LIQUEFACTIOIN PLANT REPLACEMENT AREA
BROOKLYN, KINGS COUNTY, NEW YORK

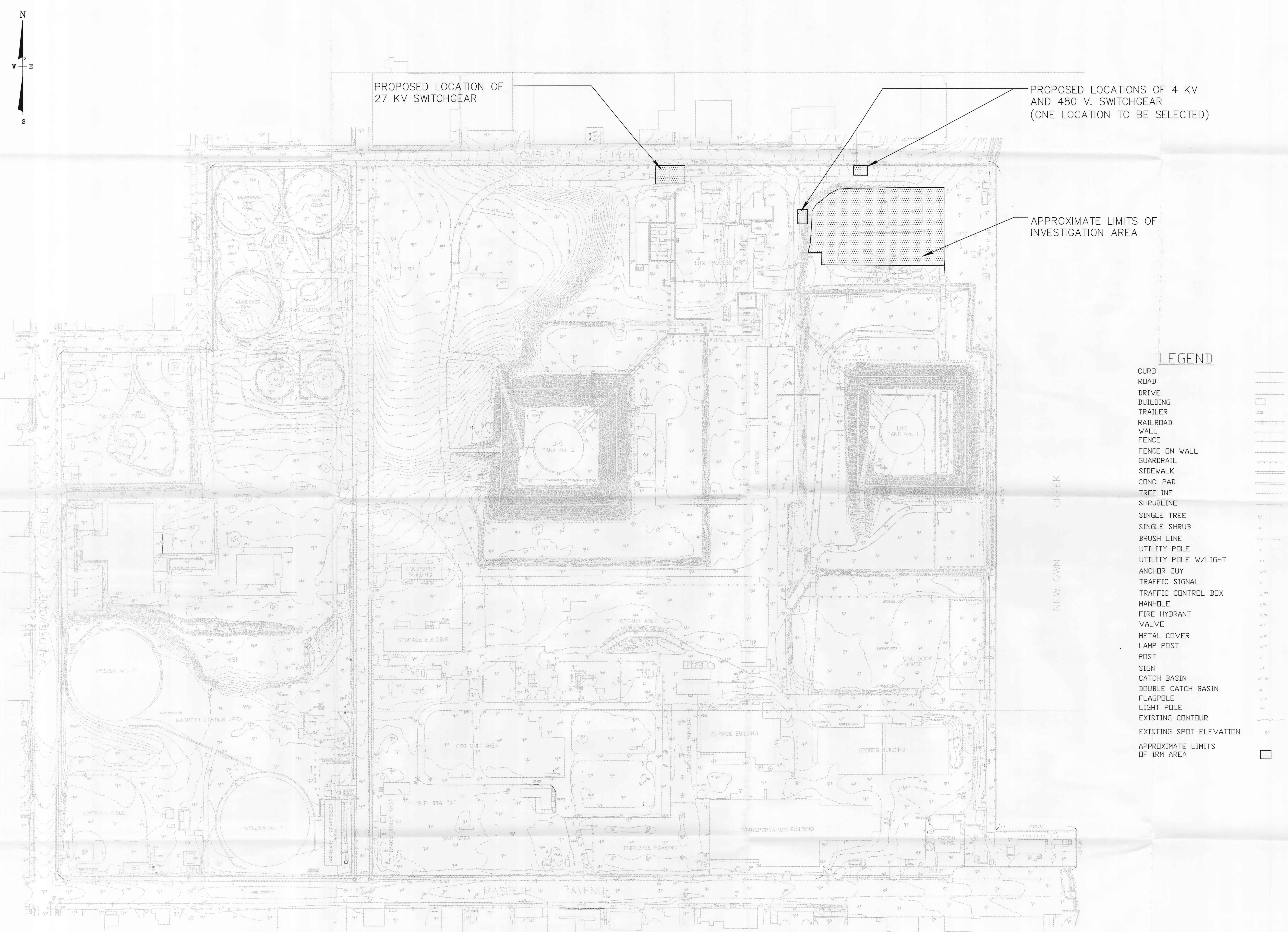
Source: BROOKLYN, N.Y. U.S.G.S. TOPOGRAPHIC QUADRANGLE (1979)

Drn. By: KJB	Scale: 1"=2000'	Proj. No.:
	Date: SEPT. 2004	Fig. No.: 1

PAULUS SOKOLOWSKI and SARTOR Engineering, PC
Engineers • Architects • Environmental Scientists
67A MOUNTAIN BOULEVARD EXTENSION
P.O. BOX 4039
WARREN, NEW JERSEY 07059
PHONE: (732) 560-9700
FAX: (732) 560-9768

N

X:\KeySpan Greenpoint\Revised SIWP July 2004\Figures\Aug 2004\Final\FIGURE 1.dwg, 8by11topotrail, 09/13/2004 08:52:33 AM, dmartocci, 672ColorE (temporary).pc3, Letter, 1:1



MAP SOURCE:

BASE MAP OF SITE PROVIDED BY KEYSPAN CORPORATION. BASE MAP TRANSPOSED FROM A PLAN ENTITLED "TOPOGRAPHIC MAP FOR GREENPOINT ENERGY CENTER, BOUNDED BY MASPETH AVENUE, VANDERVOOT AVENUE, LOMBARDY STREET AND NEWTOWN CREEK, SITUATED IN BOROUGH OF BROOKLYN, CITY OF NEW YORK, NEW YORK, PREPARED BY LYNCH, GIULIANO & ASSOCIATES, INC., NOT DATED.

130 0 130 260
GRAPHIC SCALE IN FEET (APPROXIMATE)

REVISIONS/ISSUES

NO.	DATE	DESCRIPTION

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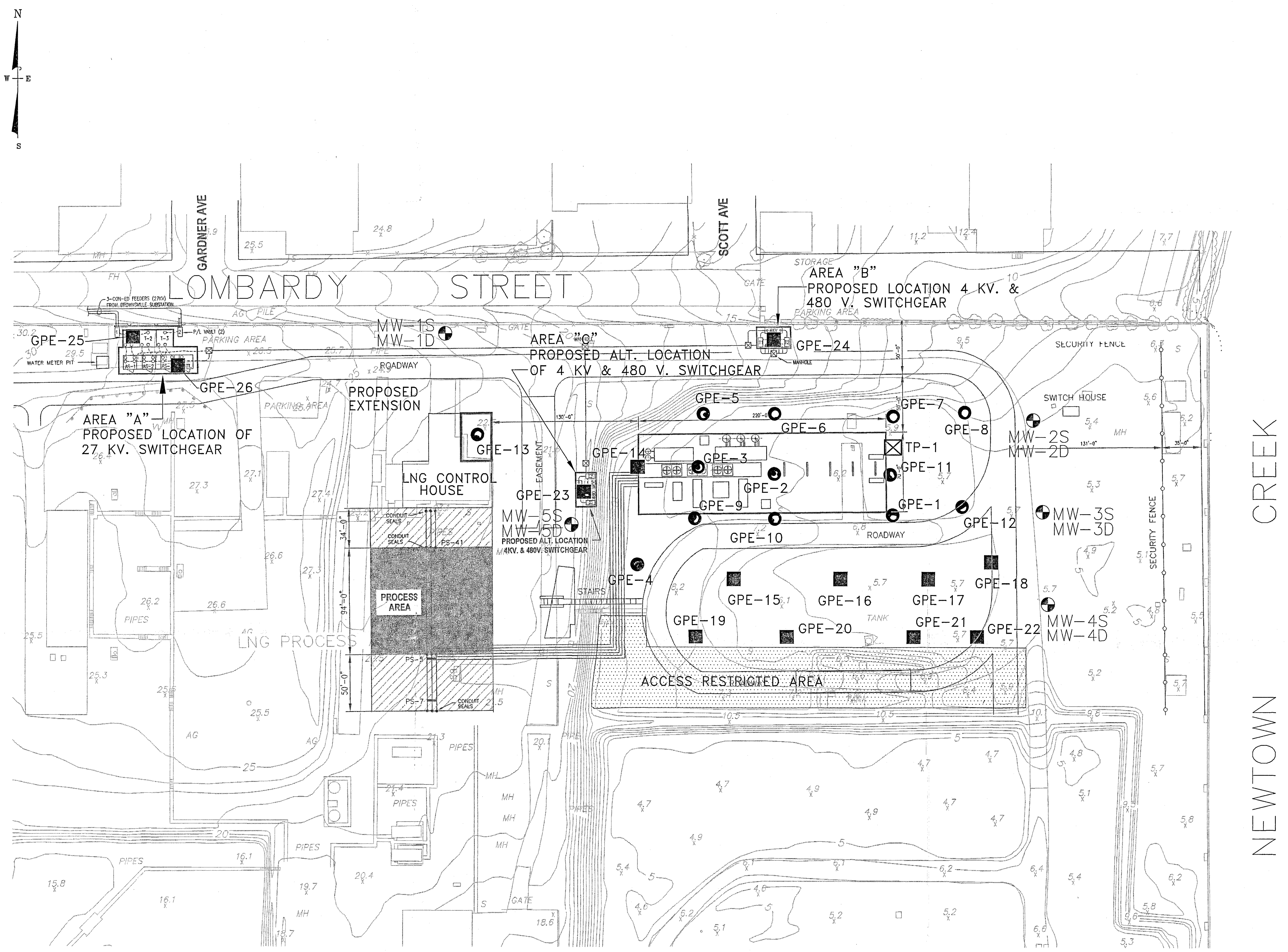
KEYSPAN CORPORATION
GREENPOINT ENERGY CENTER
PROPOSED LIQUEFACTION
PLANT REPLACEMENT AREA
BROOKLYN, NEW YORK

GREENPOINT ENERGY CENTER
SITE PLAN

DATE: OCT. 2004	JOB NO. 2522.033.044
SCALE 1" = 130'	
DRAWN DMM	SHEET NO. FIGURE 2
CHKD. JWW	

APPENDIX A

HISTORICAL SITE PLANS



LEGEND

CURB	
ROAD	
DRIVE	
BUILDING	
TRAILER	
RAILROAD	
WALL	
FENCE	
FENCE ON WALL	
GUARDRAIL	
SIDEWALK	
CONC. PAD	
TREELINE	
SHRUBLINE	
SINGLE TREE	
SINGLE SHRUB	
BRUSH LINE	
UTILITY POLE	
UTILITY POLE W/LIGHT	
ANCHOR GUY	AG
TRAFFIC SIGNAL	
TRAFFIC CONTROL BOX	TCB
MANHOLE	MH
FIRE HYDRANT	FH
VALVE	V
METAL COVER	MC
LAMP POST	LT
POST	
SIGN	S
CATCH BASIN	
DOUBLE CATCH BASIN	
FLAGPOLE	FP
LIGHT POLE	
ACCESS RESTRICTED AREA DUE TO THE PRESENCE OF EXISTING SITE UTILITIES	
PREVIOUSLY INSTALLED SOIL BORING	GPE-8
PROPOSED ADDITIONAL SOIL BORING	GPE-24
PROPOSED MONITORING WELL	MW-2S
PROPOSED TEST PIT (TP-2 LOCATION TO BE DETERMINED IN FIELD)	TP-1

GRAPHIC SCALE IN FEET (APPROXIMATE)
50 25 0 50 100

REVISIONS/ISSUES		
NO.	DATE	DESCRIPTION

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KEYSPAN CORPORATION
GREENPOINT ENERGY CENTER
PROPOSED LIQUEFACTION
PLANT REPLACEMENT AREA
BROOKLYN, NEW YORK

PROPOSED SOIL BORING/TEST PIT AND MONITORING WELL LOCATIONS SITE PLAN

DATE	OCT. 2004	JOB NO.	2522.033.044
SCALE	AS SHOWN		
DRAWN	DMM	SHEET NO.	FIGURE 3
CHKD.	JWW		

NOTES:

1) EXISTING BORING LOCATIONS SHOWN ON THIS PLAN ARE APPROXIMATE AND BASED ON FIELD MEASUREMENTS. BORING LOCATIONS ARE SUBJECT TO FIELD SURVEY VERIFICATION.

2) BASEMAP OBTAINED FROM DRAWING ENTITLED, TOPOGRAPHIC MAP FOR GREENPOINT ENERGY CENTER BOUNDED BY MASBETH AVENUE, VANDORVOORT AVENUE, LOMBARDY STREET, & NEWTOWN CREEK" DATED SEPTEMBER 24, 1999 AND PREPARED BY LYNCH, GIULIANO & ASSOCIATES, INC.

LOMBARDY

STEWART AVE

GARDNER AVE

SCOTT AVE

ST.

BEADEL ST.

PORTER AVE.

VARICK AVE.

DIVISION PL.

RICHARDSON ST.

FROST ST.

WITHERS ST.

JACKSON ST.

SKILLMAN AVE

VANDERVOORT

MASPETH AVE.

NEWTOWN CREEK

30 FT SEWER EASEMENT

Dockhead Line

SECOND PROPANE TANK FARM

LIQUID PETROLEUM STORAGE TANK AREA

FIRST PROPANE TANK FARM

DEHYDRATION PLANT

SERVICE BUILDING

TRANSPORTATION BUILDING

STORES BUILDING

NON-OPERATING PROPERTY (OTHER PHYSICAL PROPERTY) AREA 30 FT.

Purifiers

HOLDER Nº2 CAP. 17,000,000 CUBIC FT. 256'-3½" DIA. WATERLESS

HOLDER Nº1 CAP. 12,000,000 CUBIC FT. 227'-0" DIA. WATERLESS

LOT 1 BLOCK 2837

LOT 1 BLOCK 2838

LOT 15 BLOCK 2851

LOT 25 BLOCK 2850

PROPERTY OF THE BROOKLYN UNION GAS COMPANY

GREENPOINT WORKS

SCALE 1 IN = 80 FT.

SECTION 10

VOLUME 1

Building dimensions taken inside at 1st floor. Heights are least dimensions from 1st floor to trusses or roof beams.

CORRECTED TO

TOTAL AREA SQ. FT.

SUPERSEDED SPIE

THIS PRINT IS LOANED. IS NOT TO BE COPIED AND MUST BE RETURNED.

REFERENCES

REVISIONS

THE BROOKLYN UNION GAS CO.

BROOKLYN, N.Y.

GREENPOINT WORKS

PROPERTY PLAN

SCALE: 1" = 80' | DATE: JAN. 18, 1950

REPRODUCED & CORRECTED

DRAWING No. 10 A 76

Annex Bldg 23


LOMBARDY
ST.
BEADEL
ST.
AVE.
PORTER
AVE.
DIVISION
PL.
RICHARDSON ST.
FROST ST.
WITHERS ST.
JACKSON ST.
VANDERVOORT
VARICK
AVE.
STEWART
ST.
Property Line
SECOND PROPANE
TANK FARM
NON-OPERATING PROPERTY
(OTHER PHYSICAL PROPERTY)
NEW CYCLONE FENCE
369'-2"
LOT 1
BLOCK
2838
LOT
BLOCK
2837
30 FT. SEWER EASEMENT
Legal Bulkhead Line
NEWTOWN
CREEK
PROPERTY
THE BROOKLYN UNION GAS COMPANY
GREENPOINT WORKS
SECTION 10
VOLUME 1
Building dimensions taken inside at 1st floor
Heights are least dimensions from 1st floor
to trusses or roof beams
CORRECTED TO
TOTAL AREA 5,105,764 SQ FT

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

APPENDIX B

REVISED SITE INVESTIGATION WORK PLAN QUALITY ASSURANCE PROJECT PLAN (QAPP)

- FOR THE -

Greenpoint Energy Center
Proposed Liquefaction Plant Replacement Area
Brooklyn, Kings County, New York

Submitted by:
KeySpan Corporation
One Metrotech Center
Brooklyn, New York 11210-3850

Prepared by:

PAULUS
SOKOLOWSKI and
SARTOR Engineering, PC
Engineers • Architects •
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AUGUST 2004

Reviewed and Approved by:
(Project Quality Assurance Manager) (Signature) 9/13/04 (Date)

Site Specific
Revisions Attached: Supplement No. ____Date _____

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 GENERAL

This Quality Assurance Project Plan (QAPP) has been prepared to specify procedures that will provide data of known, documented quality, and which will be legally defensible, should the need exist. To the extent discrepancies exist between this QAPP and the Revised Site Investigation Work Plan (RSIWP), the RSIWP shall control.

2.0 PROJECT DESCRIPTION

The Greenpoint Energy Center is located at the intersection of Vandervoort Avenue and Maspeth Avenue in the Greenpoint Section of Brooklyn, New York. The location of the Site is depicted on Figure 1 included in Appendix A of the RSIWP. The Center is bound to the north by Lombardy Street, to the east by Newtown Creek, to the south by Maspeth Avenue and to the west by Vandervoort Avenue. The Proposed Liquefaction Replacement Plant Area is located in the northeastern corner of the Center in an area bound by Lombardy Street and Newtown Creek. The overall layout of the Greenpoint Energy Center is depicted on Figure 2 included in the RSIWP. The location and overall layout of the Proposed Liquefaction Plant Replacement Area is depicted on Figure 3. This area of the Greenpoint Energy Center is located adjacent to and north of a former manufactured gas plant (MGP) site located in the southeastern corner of the Center. The area of the proposed liquefaction plant replacement is not known to have been part of any of the Greenpoint Energy Center operational activities or the former MGP activities.

The Proposed Liquefaction Plant Replacement is reported to include the construction of an extension (approximately 125 feet by 45 feet) to the existing Control Building, the construction of a new LNG Plant Area Building (approximately 110 feet by 75 feet), the addition of two switchgear yards, and the installation of approximately 500 linear feet of overhead piping.

Additional descriptions of the project activities as well as the Site are provided in Section 1.0 and 2.0 of the SIWP.

2.1 Purpose of the Revised Site Investigation Activities

The site investigation activities have been developed to (1) investigate the presence/absence of impacts in the soils underlying the Proposed Liquefaction Plant Replacement Area of the Greenpoint Energy Center; and (2) provide sufficient information to support the determination of the need for and selection of any remedial actions required and to delist the proposed LPRA from the Greenpoint Energy Center former MGP site.

This Scope of Work was prepared based on a review of readily available information regarding the Site as provided by KeySpan. In general, the site investigation is proposed to include the installation of soil borings, test pits and groundwater monitoring wells, the collection of soil and groundwater samples from the soil borings and monitoring wells, and the laboratory analysis of the samples.

3.0 PROJECT ORGANIZATION

A project organization has been developed to identify the roles and responsibilities of the various parties involved with the supplemental investigation. The organizational structure for this investigation includes New York State Department of Environmental Conservation (NYSDEC), KeySpan Corporation (KeySpan), Paulus, Sokolowski and Sartor Engineering P.C. (PS&SPC), and the required subcontractors (i.e., analytical and geotechnical laboratories, drillers, etc). Although the Quality Assurance/Quality Control (QA/QC) responsibilities are principally the responsibility of the PS&SPC Project Manager and Project Quality Assurance Manager (PQAM), proper implementation of QA/QC requirements necessitate that the entire project staff be cognizant of all procedures and goals. A field program organization chart is presented as Figure 1.

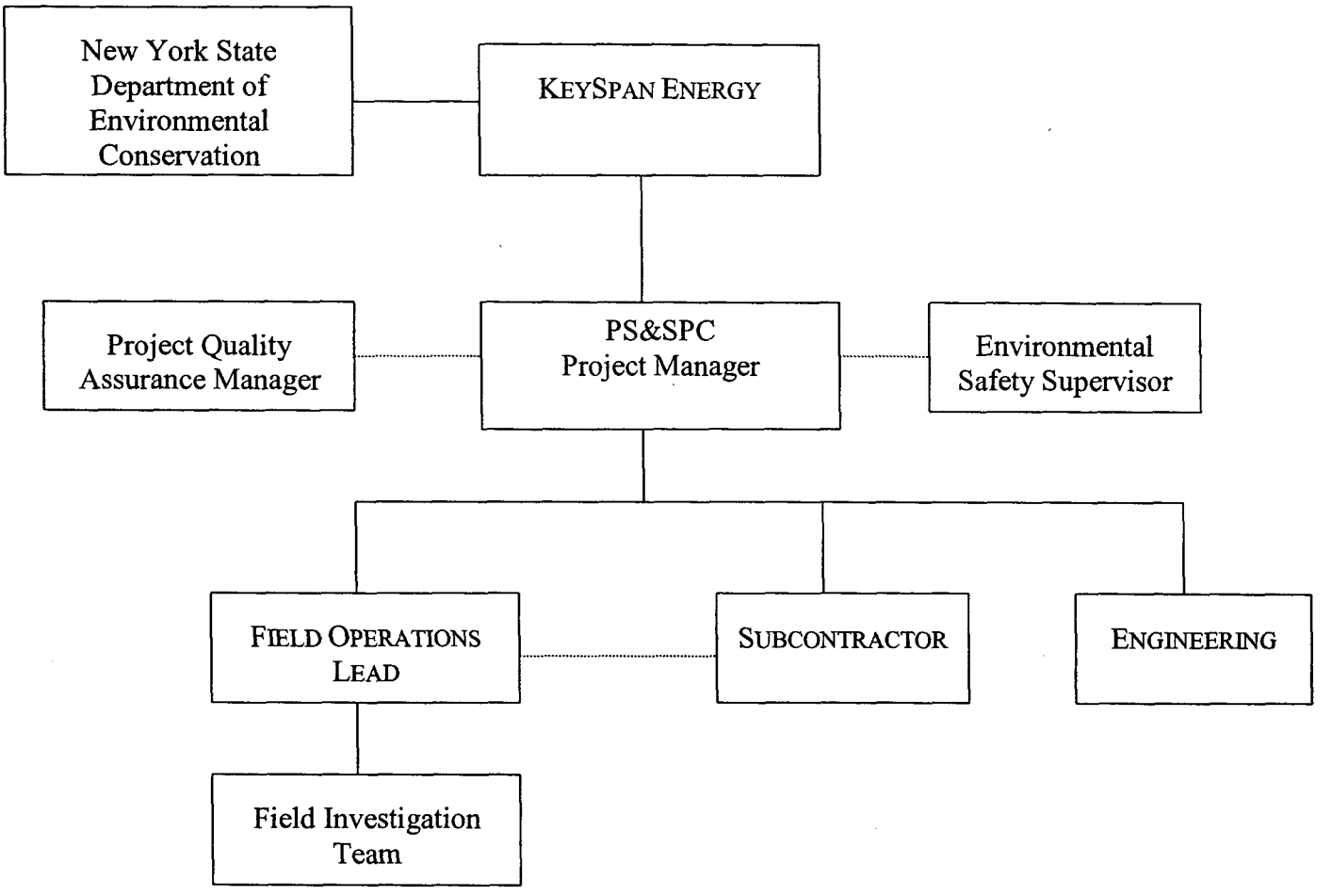
The PS&SPC team will consist of the following personnel, with a description of their responsibilities:

Joseph Walsh is the Project Manager for the Proposed Liquefaction Replacement Plant environmental investigation project. He has primary responsibility and authority for implementing and executing the technical, QA, and administrative aspects of the pre-design investigation, including the overall management of the project team. The Project Manager is accountable for ensuring that the supplemental investigation is conducted in accordance with applicable plans and guidelines, including the RDWP, the QAPP, and the Site-Specific Health and Safety Plan (HASP). In addition, the Project Manager will communicate all technical, QA and administrative matters to KeySpan. He will ensure that any deviations from the approved RSIWP, QAPP, and Site-Specific HASP are documented and communicated to KeySpan personnel.

Engineering support for the investigation will be the responsibility of Dan Martoccia, the Project Engineer. His duties include overseeing the preparation of project deliverables.

John Pastorick is the Project Quality Assurance Manager (PQAM) and will be responsible for review of data upon receipt from the analytical laboratory. The PQAM will assure that data validation screening is performed by trained and experienced data validators using the applicable criteria specified in the NYSDEC 2001 Analytical Services Protocol (ASP). For the purposes of this document, all references to ASP indicate the 2001 NYSDEC Analytical Services Protocol. The specific requirements for data validation screening are given in Section 9.3. The PQAM will be responsible for ensuring that all analytical data are in conformance with requirements of this QAPP.

Figure 1
Program Organization Structure



The Field Operations Lead (FOL) is Janos Szeman. The FOL will be responsible for the management and supervision of the field investigation and for providing consultation and decision-making on day-to-day issues relating to the sampling activities. The FOL will monitor the sampling to determine that operations are consistent with plans and procedures, and that the data acquired meets the geotechnical data quality needs. When necessary, the FOL will document any deviations fiom the plans and procedures for approval.

The Health and Safety Officer (HSO) is Jack Van Sciver. The HSO reports to the PS&S PC Project Manager, and is responsible for the implementation of the Health and Safety Plan. The HSO shall advise project staff on health and safety issues, conduct health and safety training sessions, and monitor the effectiveness of the health and safety program conducted in the field.

In addition, other site personnel may provide support to the Project Manager and FOL on an as-needed basis.

The services of an analytical laboratory subcontractor will also be necessary to perform the supplemental investigation activities. The Project Manager, with assistance from the FOL and PQAM, will be the liaison between PS&SPC, KeySpan, and the analytical laboratory subcontractor.

4.0 QA/QC OBJECTIVES FOR MEASUREMENT OF DATA

The overall quality assurance (QA) objective for the project is to develop and implement procedures that will provide data of known, documented quality. Laboratory quality assurance/quality control (QA/QC) requirements defined in the NYSDEC ASP and other applicable guidelines ensure acceptable levels of data quality will be maintained throughout the sampling and analysis program.

The QA/QC objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. The data reduction, validation, and reporting scheme is presented in Figure 2.

4.1 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), and relative range are common. For this project, precision will be evaluated by recording duplicate measurements of the same parameter on similar sample aliquots under the same conditions and calculating the relative percent difference (RPD) between the values. The formula for calculating RPD is presented in Section 13.2.

RPDs can only be calculated when the duplicate samples both contain detectable concentrations of the analyte. If an analyte is considered not detected at the detection limit, then RPD cannot be calculated. Instead, the results of the analysis of the two spiked laboratory samples will be used to determine precision.

Data for this project will include laboratory analytical data. Laboratory precision will be performed according to the requirements described in the associated analytical methods. The geotechnical data will be collected following the requirements of the American Society of Testing Materials (ASTM) and other applicable guidelines.

For the pH meter, precision will be tested by multiple readings in the medium of concern. Consecutive readings should agree within 0.1 pH units after the instrument has been field calibrated with standard buffers before each use. The thermometer will be visually inspected prior to each use to ensure its condition is satisfactory. Consecutive measurements of a given sample should agree to within 1°Celsius. After calibration, the conductivity meter will be tested for precision at ± 1% of full-scale, depending on the meter/scale. The organic vapors will be measured using a Photovac Microtip (or equivalent) photoionization detector (PID). The natural variation/fluctuation in measurements at background or upwind locations will be used for baseline background values, and the variability will be noted. Water level indicator readings will be precise within 0.01 feet for duplicate measurements or additional water level measurements

will be collected to determine whether the difference is due to operator or instrument error. Turbidity measurements will be calibrated to a precision of ± 2% nephelometric turbidity units (NTUs).

4.2 Accuracy

Accuracy is a measure of the difference between a measured value and the "true" or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity which is recovered, or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes that are close to the detection limits are less accurate because they are affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument or other variables and thus will be more accurate.

The accuracy of laboratory-measured data will be evaluated by determining the percent recovery of both matrix and blank spike samples as described in Section 13.1. For the measurement of organics by gas chromatography (GC) or GC/mass spectroscopy (MS), the recovery of a surrogate spiked into each sample, blank, and standard will also be used to assess accuracy.

The objective for accuracy of the other field measurements is to achieve and maintain factory equipment specifications for the field equipment. Field measurements cannot be assessed for accuracy by spiking the medium with the analytical parameter and measuring the increase in response; therefore, these instruments can only be assessed for accuracy by the response to a known sample (such as a calibration standard) used to standardize them. The pH meter, conductivity meter, and turbidity meter are calibrated with solutions traceable to the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards).

All volatile organic detectors (such as the PID) will be calibrated to an appropriate standard daily prior to use.

4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible; that the data derived represents the in-place quality of the material

sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, or analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the SAP. Laboratory sample containers will be thoroughly cleaned in accordance with procedures outlined in Section 5.2. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated through the analysis of field duplicate samples, coded to ensure the samples are treated and analyzed as separate samples. The analytical laboratory will make every reasonable effort to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received. Many means of homogenization expose the sample to significant risk of contamination or loss through volatilization, and these should be avoided if possible.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank/duplicate and chain-of-custody procedures are presented in Sections 5.3 and 6.1.

4.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. The QC objective for completeness is generation of valid data for 100 percent of the analysis requested. Any data deficiencies and their impact on project goals will be evaluated during data validation and discussed in the Data Usability Summary Report (DUSR) (see Section 9.3.2).

4.5 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Ensuring traceability of all analytical standards and/or source materials to United States Environmental Protection Agency (USEPA) or NIST;
- Verifying all calibrations with an independently prepared standard from a source other than that used for calibration;
- Using standard reporting units and reporting formats including the reporting of QC data;
- The validation of all analytical results, including the use of data qualifiers in all cases where appropriate; and

- The requirement that all validated flags are to be used any time an analytical result is used for any purpose whatsoever.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

5.0 SAMPLING PROCEDURES

5.1 Sampling Program

The objective of the sampling program is to assess the presence/absence of impacts to soils underlying for the Proposed Liquefaction Plant Replacement Area. Sampling and analysis may include, as identified in the Revised Site Investigation Work Plan, groundwater and soil samples.

5.2 Sampling Procedures and Handling

5.2.1 Sample Container Preparation

Sample containers will be properly washed and decontaminated by the factory or laboratory prior to use. All preservatives will be added to containers prior to shipment by the laboratory. The types of containers and preservation techniques are shown in Table 1. Records of the sources of bottles and preservatives will be kept by the analytical laboratory.

5.2.2 Methods of Sampling

As a minimum, sampling procedures will be in accordance with the most recent NYSDEC or USEPA guidelines and/or regulations, as appropriate. Alternate techniques will be utilized when such guidelines and/or regulations are inappropriate or non-existent.

Referenced sampling procedures are listed below. All procedures will be the latest in effect as of the date of this Generic QAPP.

- USEPA - 600-4-79-020, "Methods for Chemical Analysis of Water and Wastes"
- National Water Well Association - "Manual of Ground-water Sampling Procedures"
- USEPA - 600-4-83-040, "Characterization of Hazardous Waste Sites - a Methods Manual: Volume II. Available Sampling Methods"
- USEPA - OSWER - 9950.1 "RCRA Ground-water Monitoring Technical Enforcement Guidance Document"
- USEPA - 540/S-95/504, "Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures"
- NYSDEC – "Technical and Administrative Guidance Memoranda" (TAGMs)

5.3 Quality Assurance Samples

5.3.1 Field Quality Control Samples

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. The blanks will include:

Trip Blank - A trip blank will be prepared by the laboratory, and will consist of 40-ml volatile organic analysis (VOA) vials containing distilled, deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for which analysis for Target Compound List (TCL) volatiles or benzene, toluene, ethylbenzene and total xylenes (BTEX) is planned. The trip blank will be analyzed for TCL volatile organic compounds or BTEX to assess any contamination introduced as a result of sampling and transport, handling and storage.

Equipment Blank - Equipment blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix as specified in the Supplemental Investigation Work Plan. Equipment blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory which has passed through or over the sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to collecting a sample. The equipment blanks will be analyzed for the same parameters as the matrix being sampled.

In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike (MS)/matrix spike duplicates (MSD)/matrix duplicates (MD).

The duplicates will consist of:

Field Duplicate - To determine the reproducibility and homogeneity of samples, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise. The frequency of collection of these samples is one per 20 field samples as specified in the Remedial Design Work Plans. The criteria for assessing coded field duplicates are given in Section 6.0.

Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate (MS/MSD/MD) - MS/MSD/MD samples (MSD for organics; MD for inorganics) will be collected at a frequency of one pair per 20 field samples per seven day sample delivery group (SDG). The reproducibility and homogeneity of the samples can be assessed by determining the RPD for both spike and non-spike compounds as described in Section 13.0. The MS,

MSD, and MD samples should be Site-specific, unless otherwise authorized by the Consultant's Project Manager and/or PQAM.

6.0 SAMPLE TRACKING AND CUSTODY

Sample chain-of-custody (COC) will be initiated by the laboratory with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling the samples will be minimized.

In-situ or on-site monitoring data will be controlled and entered in permanent logbooks. Personnel involved in the COC and transfer of samples will be trained on the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity will be provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 3. A sample will be considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with custody seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

6.1 Field Sample Custody

A COC record will accompany the sample from time of collection to receipt by the analytical laboratory. If samples are split and sent to different laboratories, COC records will be sent with each sample. Figure 4 is a typical example of a chain-of-custody record. The "remarks" column will be used to record specific considerations associated with sample acquisition such as: sample type, container type, sample preservation methods, and analyses to be performed. Two copies of this record will accompany the samples to the laboratory. The laboratory will maintain one file copy, and the completed original will be returned to the Consultant's Project Manager.

Individual sample containers, provided by the laboratory, will be used for shipping/couriering samples. The shipping containers are insulated, and ice will be used to maintain samples at approximately four degrees Celsius until samples are returned and in the custody of the laboratory. All sample bottles within each shipping container will be individually labeled and controlled.

Each sample shipping container will be assigned a unique identification number by the laboratory, and will be marked with indelible ink on the outside of the shipping container. This number will be recorded on the COC record. The field sampler will indicate each individual

sample designation/location number in the space provided on the appropriate COC form for each sample collected. The shipping container will then be closed, and a seal provided by the laboratory affixed to the latch. This seal must be broken to open the container. Tampering may be indicated if the seal is broken before receipt at the laboratory. The laboratory will contact the FOL or Consultant's Project Manager, and the associated samples will not be analyzed if tampering is apparent.

6.2 Laboratory Sample Custody

The FOL will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The laboratory sample program will meet the following criteria:

- The laboratory will designate a sample custodian who is responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of any discrepancy in documentation, the laboratory will immediately contact the Consultant's Project Manager and/or PQAM as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. That assessment will be recorded as part of the incoming COC procedure.
- The samples will be stored in a secured area at a temperature of approximately four degrees Celsius until analyses are to commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking form will accompany the laboratory report and will become a permanent part of the project records.

6.3 Sample Tracking System

A sample tracking system will be implemented to monitor the status of sampling events and laboratory analysis of samples. Sample numbers, types, analytical parameters, sampling dates,

and sample delivery group (SDG) designations for samples, and required due dates for receipt of analytical results will be entered into the system. The Consultant's Project Manager will use the tracking system to monitor the project sampling schedules and the status of analytical reports, and to implement any penalty clauses for late delivery per standard laboratory subcontracts when necessary.

A description of the sample tracking system follows:

1. For each day that samples are collected, the Field Operations Lead (FOL) or designee will complete a COC form (Figure 4) and a Daily Status and Monitoring Report (Figure 5) listing all appropriate samples.

2. The FOL or designee will retain the client copy of the COC, and forward the laboratory copy of the COC with the sample shipment.

3. The FOL or designee will fax copies of the completed COC form and Daily Status and Monitoring Report to the Consultant's Project Manager. The Consultant's Project Manager or a designated employee will confirm sample shipment with the laboratory and resolve any sample transfer issues.

4. The status of analytical results will be tracked by the Consultant's Project Manager or designee using the information provided on the completed COC form and Daily Status and Monitoring Report. The information shall be summarized in a computerized database, as warranted.

Upon receipt of the analytical results from the laboratory, the Consultant's Project Manager or designee will review the data package for completeness and contract compliance. The Consultant's Project Manager will then forward the result package to the data validator for validation. The data validator shall be required to submit a complete set of validated data to the Consultant's Project Manager within 60 days of receipt of the data package report.

The Consultant's Project Manager or a designated representative will maintain day-to-day contact with the laboratory concerning specific samples and analyses directly or by assignment.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 Field Instrumentation Calibration

The FOL will be responsible for ensuring that instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to their specific calibration protocols/procedures.

All field measurement instruments must be calibrated according to the manufacturer's instructions prior to the commencement of the day's activities. Exceptions to this requirement shall be permitted only for instruments that have fixed calibrations pre-set by the equipment manufacturer. Calibration information shall be documented on instrument calibration and maintenance log sheets or in a designated field logbook. The calibration information (log sheet or logbook) shall be maintained at the site during the on-site investigation and, once the field work is completed, shall be placed in the Consultant's project files. Information to be recorded includes the date, the operator, and the calibration standards (concentration, manufacturer, lot number, expiration date, etc.). All project personnel using measuring equipment or instruments in the field shall be trained in the calibration and usage of the equipment, and are personally responsible for ensuring that the equipment has been properly calibrated prior to its use.

In addition, all field instruments must undergo response verification checks at the end of the day's activities and at any other time that the user suspects or detects anomalies in the data being generated. The checks consist of exposing the instrument to a known source of analyte (e.g., the calibration solution), and verifying a response. If an unacceptable instrument response is obtained during the check (i.e., not within specifications), the data shall be labeled suspect, the problem documented in the site logbook, and appropriate corrective action taken.

Any equipment found to be out of calibration shall be re-calibrated. When instrumentation is found to be out of calibration or damaged, an evaluation shall be made to ascertain the validity of previous test results since the last calibration check. If it is necessary to ensure the acceptability of suspect items, the originally required tests shall be repeated (if possible), using properly calibrated equipment, to acquire replacement data for the measurement in question.

Any instrument consistently found to be out of calibration shall be repaired or replaced within 24 hours or field work will be terminated until the malfunctioning equipment is repaired/replaced.

7.2 Laboratory Instrumentation Calibration

Personnel at the laboratory will be responsible for ensuring that analytical instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to specific protocols/procedures.

Off-site laboratory equipment shall be calibrated using certified/nationally recognized standards and according to the applicable methodologies and the laboratory Standard Operating Procedures (SOPs). In addition, these methods/procedures specify the appropriate operations to follow during calibration or when any instrument is found to be out of calibration.

8.0 ANALYTICAL PROCEDURES

All off-site laboratory samples will be analyzed according to the methods provided in Exhibit D of the NYSDEC ASP. QA/QC procedures given in Exhibit E and I of the ASP will be followed. Regardless of the method used, all analytical and extraction holding times must meet the NYSDEC ASP requirements for that analytical group (i.e., volatile analyses, including BTEX, have a holding time of seven days, if unpreserved). Holding times will be calculated from verified time of sample receipt at the laboratory. For NYSDEC ASP, samples must be received at the laboratory within 48 hours of sample collection. The analytical laboratory chosen for the project will be certified, and must maintain certification, under the New York State Department of Health's Environmental Laboratory Approval Program for analyses of solid and hazardous waste. The breakdown of investigative samples is detailed in the Supplemental Investigaiton Work Plan. Laboratory analytical methods and quantitation limits are presented in Tables 2 and 3 of this QAPP. The method detection limits (MDLs) for the analytes will be specified by the laboratory selected for the project based on its most recent MDL studies, and subject to approval by the NYSDEC.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the ASP.

The data package provided by the laboratory will contain all items specified in the ASP, as appropriate to the analyses performed. Category B reporting will be used.

9.1 Chain-of-Custody Records

Completed copies of the COC records accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the report of analytical testing.

9.2 Data Handling

One complete copy and one additional copy of the analytical data summary report will be provided by the laboratory. One set of the analytical data will be forwarded directly to the data validator by the laboratory. The Consultant's Project Manager will immediately arrange for filing of the complete package, after the QA/QC reviewer checks the package to ensure all deliverables have been provided. The second data summary report will be used to generate summary tables. These tables will form the foundation of a working database for assessment of the site contamination condition.

The Consultant's Project Manager will maintain close contact with the QA/QC reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA/QC review has been completed, the Consultant's Project Manager may direct the team leaders or others to initiate and finalize the analytical data assessment.

9.3 Data Validation

9.3.1 Full Data Validation

Data validation is a basic step in the control and processing of the project data generated by the laboratory. The data validation process will consist of a systematic review of the analytical results and QC documentation, and will be performed in accordance with the guidelines identified in Section 9.3.1. On the basis of this review, the data validator will make judgments and express concerns and comments on the quality and limitations of specific data, as well as on the validity of the overall data package. The data validator will prepare documentation of his or her review and conclusions in a Data Usability Summary Report (DUSR; see Section 9.3.2).

The data validator will inform the Consultant's Project Manager of data quality and limitations, and assist the Project Manager in interacting with the laboratory to correct data omissions and deficiencies. The laboratory may be required to rerun or resubmit data depending on the extent of the deficiencies, and their importance in meeting the data quality objectives within the overall context of the project. The validated laboratory data will be reduced into a computerized

tabulation which will be suitable for inclusion in required reports and will be designed to facilitate comparison and evaluation of the data. The data tabulations will be sorted by classes of constituents and by sample matrix. Each individual table will present the following information:

- Sample matrix, designations, and locations;
- Sample dates;
- Constituents for which positive results were obtained;
- Reported constituent concentrations in the field and/or trip blanks associated with the samples;
- Constituent concentration units;
- Name and location of laboratory which performed the analyses;
- Data qualifiers provided by the laboratory; and
- Data qualifiers and comments provided by the data validator, if any.

9.3.2 Data Usability Summary Report (DUSR)

A Data Usability Summary Report (DUSR) will be prepared after reviewing and evaluating the analytical data. The parameters to be evaluated in reference to compliance with the analytical method protocols includes all sample chain-of-custody forms, holding times, raw data (instrument print out data and chromatograms), calibrations, blanks, spikes, controls, surrogate recoveries, duplicates and sample data. If available, the field sampling notes should also be reviewed and any quality control problems should be evaluated as to their effect on the usability of the sample data.

The DUSR will describe the samples and analysis parameters reviewed. Data deficiencies, analytical method protocol deviations and quality control problems will be described and their effect on the data will be discussed in the DUSR.

Resampling/reanalysis recommendations, if applicable, will be made. Data qualifications are documented for each sample analyte following the NYSDEC ASP guidelines.

This work will be performed by trained and experienced data validators. The results of the data validation screening (i.e. missed holding times or data rejected due to blank contamination) will be incorporated into the data summary tables used in the final investigative report. The DUSR identifies data gaps caused by non-compliant or rejected data, and will indicate what steps have been or will be taken to fill these gaps.

10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

10.1 Quality Assurance Batching

Each set of samples will be analyzed concurrently with calibration standards, method blanks, MS, MSD or MD, and QC check samples (if required by the protocol). The MS/MSD/MD samples will be designated by the field personnel. If no MS/MSD/MD samples have been designated, then the laboratory must contact the PQAM or Consultant's Project Manager for corrective action.

10.2 Organic Standards and Surrogates

All standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or earlier based upon data indicating deterioration.

10.3 Laboratory Quality Control Samples

The quality control samples included are detailed below.

Method Blanks/Preparation Blanks: Analyses for organic compounds (method blank) and inorganics (preparation blank) include a blank analysis of the laboratory reagent water. The blank is analyzed with each set of samples or more often as required to verify that contamination has not occurred during the analytical process. The concentration of target compounds in the blanks must be less than or equal to the method detection limits specified in the ASP for the selected method of analysis.

Matrix Spike/Matrix Spike Duplicate Analysis: - This analysis is used to determine the effects of matrix interference on analytical results. Spikes of analytes are added to aliquots of sample matrix in the manner specified in the ASP. Selected samples are spiked to determine accuracy as a percentage recovery of the analyte from the sample matrix and precision as RPD between the MS and MSD samples. A matrix duplicate is prepared in the same manner as the matrix spike sample.

Analytical Duplicate Samples: Replicate samples are aliquots of a single sample that are split on arrival at the laboratory, or upon analysis. Significant differences between two replicates, split in a controlled laboratory environment, will result in flagging the affected analytical results.

Surrogate Spike Analyses: Surrogate spike analyses are used to determine the efficiency of recovery of organic analytes in the sample preparations and analyses. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method.

Laboratory Control Sample/ (Spike Blank): For each method which requires a laboratory control sample (LCS) or spike blank, a LCS spike blank will be prepared with each quality control batch and analyzed according to criteria specified in the ASP. These samples support an assessment of the ability of the analytical procedure to generate a correct result without matrix effects or interference affecting the analysis.

11.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

Quality assurance audits may be performed by the PQAM or personnel designated by the PQAM. The PQAM and his or her designees function as an independent body and report directly to Consultant's quality assurance management. The PQAM may plan, schedule, and approve system and performance audits based upon the Consultant's procedure customized to the project requirements. These audits may be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). At times, the PQAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits.

Formal audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by lead auditors after gathering and evaluating all resultant data. Items, activities, and documents determined by lead auditors to be in noncompliance will be identified at exit interviews conducted with the involved management. Noncompliances will be logged, documented, and controlled through audit findings which are attached to and are a part of the integral audit report. These audit finding forms will then be directed to management to satisfactorily resolve the noncompliance in a specified and timely manner. All audit checklists, audit reports, audit findings, and acceptable resolutions must be approved by the PQAM prior to issue. QA verification of acceptable resolutions will be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the PQAM will close out the audit report and findings.

It is the Consultant's Project Manager's overall responsibility to verify that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Consultant's Project Manager within 15 days of completion of the audit. Serious deficiencies must be reported to the Consultant's Project Manager within 24 hours.

11.1 System Audits

System audits, performed by the PQAM or designated auditors, may encompass evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Consultant's Project Manager requests the PQAM to perform unscheduled audits, these activities will be instituted.

11.2 Performance Audits

In accordance with the requirements for NYSDOH ELAP CLP certification, the laboratory will participate in all performance evaluation testing.

Also, one field audit may be performed by the PQAM or designated auditor during collection of the field samples to verify that field samplers are following established sampling procedures. Performance of a field audit will be based on the type of investigation activities being performed, the length of the field project, and any available information concerning prior inspections of the project or sampling team.

12.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

12.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators. Analytical instruments will be serviced at intervals recommended by the manufacturer. An instrument repair/maintenance log book will be kept for each instrument. Entries include the date of service, type of problem encountered, corrective action taken, and initials and affiliation of the person providing the service.

The instrument use log book will be monitored by the analysts to detect any degradation of instrument performance. Changes in response factors or sensitivity are used as indications of potential problems. These are brought to the attention of the laboratory supervisor and preventive maintenance or service is scheduled to minimize down time. Back-up instrumentation and an inventory of critical spare parts are maintained to minimize delays in completion of analyses.

Use of equipment in need of repair will not be allowed, and field work will be terminated until the malfunction is repaired or the instrument replaced.

12.2 Schedules

Written procedures, where applicable, will identify the schedule for servicing critical items in order to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange any necessary and prompt service as required. Service to the equipment, instruments, tools, gauges, etc. shall be performed by qualified personnel.

12.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools, and gauges are used at the sites. The Consultant's Project Manager or the PQAM may audit these records to verify complete adherence to these procedures.

12.4 Spare Parts

Where appropriate, a list of critical spare parts will be identified by the operator in consultation with the equipment manufacturer. These spare parts will be stored for availability and use in order to reduce the downtime. In lieu of maintaining an inventory of spare parts, a service contract for rapid instrument repair or backup instruments will be available.

13.0 ASSESSMENT PROCEDURES FOR DATA ACCEPTABILITY

Procedures used to assess data precision and accuracy will be in accordance with the appropriate laboratory method, and as periodically updated.

13.1 Accuracy

The percent recovery is calculated as below:

$$\% = \frac{Ss - So}{S} \times 100$$

So = The background value, i.e.; the value obtained by analyzing the sample

S = Concentration of the spike added to the sample

Ss = Value obtained by analyzing the sample with the spike added

% = Percent Recovery

13.2 Precision

The relative percent difference (RPD) is calculated as below:

$$RPD = \frac{|V1 - V2| \times 100}{0.5 (V1 + V2)}$$

V1, V2 = The two values obtained by analyzing the duplicate samples

13.3 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the total amount expected to be obtained under ideal conditions. A target of 100 percent completeness, calculated for each analysis method, has been established as the overall project objective.

$$PC = \frac{NA}{NI} \times 100$$

where:

PC = Percent completeness
NA = Actual number of valid analytical results obtained
NI = Theoretical number of results obtainable under ideal conditions

14.0 CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted on-site, at the laboratory, or at a subcontractor location, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the FOL, Consultant's Project Manager, and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action. All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality.

At a minimum, corrective actions may be initiated:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined deficient
- When equipment or instrumentation is found faulty
- When samples and test results are questionably traceable
- When quality assurance requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/inter-field comparison studies
- As required by NYSDEC ASP, 2001

Procedure Description

Project management and staff, such as field investigation teams and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities.

Work may be audited at Consultant's office, Site, laboratory, and subcontractor locations by the PQAM and/or designated auditor. Items, activities, or documents ascertained to be in

noncompliance with quality assurance requirements will be documented and corrective actions mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the PQAM (Section 11.0).

Technicians assigned quality assurance functions will also control noncompliance corrective actions by having the responsibility of issuing and controlling the appropriate Corrective Action Request Form (Figure 6). All project personnel may identify a noncompliance; however, the technician is responsible for documenting, numbering, logging, and verifying the closeout action. It is the Consultant's Project Manager's responsibility to verify that all recommended corrective actions are produced, accepted, and received in a timely manner.

The Corrective Action Request (CAR) identifies the adverse condition, reference document(s), and recommended corrective action(s) to be administered. The issued CAR is directed to the responsible manager in charge of the item or activity for action. The individual to whom the CAR is addressed returns the requested response promptly to the technician in charge, affixing his signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The technician maintains the log for status control of CARs and responses, confirms the adequacy of the intended corrective action, and verifies its implementation. The technician will issue and distribute CARs to specified personnel, including the originator, responsible project management involved with the condition, the Consultant's Project Manager, involved subcontractor, and the FOL, at a minimum. CARs are transmitted to the project file for the records.

15.0 QUALITY ASSURANCE REPORTS

Quality assurance reports to management may consist of the reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and the data validation report.

At the end of the project, the PQAM may submit a lessons leaned report to the Consultant's Project Manager which will discuss the QA activities. That report may include discussions of any conditions adverse or potentially adverse to quality, such as responses to the findings of any field or laboratory audits; any field, laboratory, or sample conditions which necessitated a departure from the methods or procedures specified in this QAPP; field sampling errors; and any missed holding times or problems with laboratory QC acceptance criteria; and the associated corrective actions undertaken. This report shall not preclude immediate notification to project management of such problems when timely notice can reduce the loss or potential loss of quality, time, effort, or expense.

These reports, if prepared, shall be reviewed by the Consultant's Project Manager for completeness and the appropriateness of any corrective actions, and they shall be retained in the project files.

In the final investigative report, laboratory and field QC data will be presented, including a summary of QA activities and any problems and/or comments associated with the analytical and sampling effort. Any corrective actions taken in the field, results of any audits, and any modifications to laboratory protocols will be discussed.

APPENDIX A

TABLES

TABLE 1
SAMPLE CONTAINERIZATION

Analysis	Bottle Type	Preservation[1]	Holding Time[2]
Aqueous Samples			
Volatile Organics (BTEX)	40 ml glass vial with Teflon-lined septa	Cool to 4°C	7 days
PCBs/Pesticides	1000 ml amber glass	Cool to 4°C	5 days*
Semivolatile Organics (PAHs)	1000 ml amber glass	Cool to 4°C	5 days*
Metals	1000 ml polyethene	HNO_3 to pH <2	6 months (Mercury 26 days)
Cyanide	1000 ml polyethene	NaOH to pH >12	12 days
Soil			
Volatile Organics (BTEX)	Wide-mouth glass w/ teflon-lined septa [3]	Cool to 4°C	7 days
Semivolatile Organics (PAHs)	Wide-mouth glass w/ teflon cap [3]	Cool to 4°C	5 days*
Pesticide/PCBs	Wide-mouth glass w/ teflon cap [3]	Cool to 4°C	5 days*
Metals, Cyanide	Wide mouth glass w/ teflon cap [3]	Cool to 4°C	Metals - 6 months Mercury - 26 days Cyanide - 12 days

NOTES:

1. All samples to be preserved in ice at 4°C during collection and transport.
2. Days from verified time of sample receipt (VTSR) by the laboratory.
3. Sized appropriately for the analytical method.
4. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in containerization requirements, the Remedial Design Work Plan (which will include this information) will take precedence.

* Extraction of water samples for pesticides/PCB analysis by separating funnel must be completed within five days of VTSR. Continuous liquid-liquid extraction is the required extraction for water samples for semivolatiles. Continuous liquid-liquid extraction of water samples, or sonication or soxhlet procedures for semivolatile and pesticides/PCB analyses, shall be started within five days. If a re-extraction and reanalysis must be performed, the extraction must start within 10 days and completed within 12 days of VTSR. Extracts of either water or soil/sediment samples must be analyzed within 40 days of VTSR.

TABLE 2
LABORATORY ANALYSIS PROGRAM

Matrix	Parameter [1]	Analytical Method [2]
Water	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	PCBs and Pesticides	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
Soil	BTEX	Method 8260B*
	VOC	Method 8260B *
	SVOC	Method 8270C*
	PAHs	Method 8270C*
	Pesticides and PCBs	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
	TCLP	Method 1311/6010; Method Series 7000, 8000
	TPHC – Diesel Range Organics (DRO)	Method 8015M
Waste Characteristics	TCLP Metals	Method 1311/6010
	Ignitability	Method 1010
	Corrosivity	Method 9040
	Reactivity – Sulfide/Cyanide	Method SW-846 7.3
	PCBs	Method 8082
	Total Sulfur	ASTM D129
	TCLP Organics (VOCs, SVOCs, Pesticides/Herbicides	Methods 1311/8000 Series
	TPHC	Method 8015M

NOTES:

1. Abbreviations: BTEX = Benzene, Toluene, Ethylbenzene, Xylene; VOCs = Volatile organic compounds; SVOCs = Semivolatile organic compounds; PAHs = Polycyclic aromatic Hydrocarbons; TCLP = Toxicity Characteristic Leaching Procedure; PCBs = Polychlorinated Biphenyls; CLP = Contract Laboratory Program.
2. NYSDEC Analytical Services Protocol, 2001, Category B deliverables. Analyses must meet NYSDEC ASP holding time specified for Methods in Exhibit I Part II.
3. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in analytical requirements, the Remedial Design Work Plan (which will include this information) will take precedence

* BTEX and PAH analyses must meet NYSDEC ASP holding time specified for Methods 2001-1 and 2001-2, respectively.

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL Volatile Organic Compounds (by 2001-1)		
Acetone	10	10
Benzene	10	10
Bromodichloromethane	10	10
Bromoform	10	10
Bromomethane	10	10
2-Butanone	10	10
Carbon disulfide	10	10
Carbon tetrachloride	10	10
Chlorobenzene	10	10
Chloroethane	10	10
Chloroform	10	10
Chloromethane	10	10
Dibromochloromethane	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethane	10	10
1,1-Dichloroethene	10	10
1,2-Dichloroethene (cis and trans)	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
trans-1,3-Dichloropropene	10	10
Ethylbenzene	10	10
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Methylene chloride	10	10
Styrene	10	10
1,1,2,2-Tetrachloroethane	10	10
Tetrachloroethene	10	10
Toluene	10	10
1,1,1-Trichloroethane	10	10
1,1,2-Trichloroethane	10	10
Trichloroethene	10	10
Vinyl chloride	10	10
Total Xylenes	10	10

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2) Base/Neutral Extractables		
Acenaphthene	10	330
Acenaphthylene	10	330
Anthracene	10	330
Benzo(a)anthracene	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(g,h,i)perylene	10	330
Benzo(a)pyrene	10	330
bis(2-Chloroethoxy)methane	10	330
bis(2-Chloroethyl)ether	10	330
bis(2-ethylhexyl)phthalate	10	330
4-Bromophenyl phenyl ether	10	330
Butyl benzyl phthalate	10	330
Carbazole	10	330
4-Chloroaniline	10	330
2-Chloronaphthalene	10	330
4-Chlorophenyl phenyl ether	10	330
Chrysene	10	330
Dibenz(a,h)anthracene	10	330
Dibenzofuran	10	330
Di-n-butylphthalate	10	330
1,2-Dichlorobenzene	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
3,3'-Dichlorobenzidine	10	330
Diethyl phthalate	10	330
Dimethyl phthalate	10	330
2,4-Dinitrotoluene	10	330
2,6-Dinitrotoluene	10	330
Di-n-octylphthalate	10	330
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadiene	10	330
Hexachloroethane	10	330
Indeno(1,2,3-cd)pyrene	10	330
Isophorone	10	330

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.)		
2-methyl Naphthalene	10	330
Naphthalene	10	330
2-Nitroaniline	25	800
3-Nitroaniline	25	800
4-Nitroaniline	25	800
Nitrobenzene	10	330
N-Nitroso-diphenylamine	10	330
N-Nitroso-dipropylamine	10	330
2,2' Oxybis(1-chloropropane)	10	330
Phenanthrene	10	330
Pyrene	10	330
1,2,4-Trichlorobenzene	10	330
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.) Acid Extractables (cont.)		
4-Chloro-3-methylphenol	10	330
2-Chlorophenol	10	330
2,4-Dichlorophenol	10	330
2,4-Dimethylphenol	10	330
4,6-Dinitro-2-methylphenol	25	800
2,4-Dinitrophenol	25	800
2-Methylphenol	10	330
4-Methylphenol	10	330
2-Nitrophenol	10	330
4-Nitrophenol	25	800
Pentachlorophenol	25	800
Phenol	10	330
2,4,5-Trichlorophenol	25	800
2,4,6-Trichlorophenol	10	330

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL Pesticides (by 2001-3)		
Aldrin	0.05	1.7
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Chlordane (alpha &/or gamma)	0.05	1.7
4,4'-DDD	0.10	3.3
4,4'-DDE	0.10	3.3
4,4'-DDT	0.10	3.3
Dieldrin	0.10	3.3
Endosulfan I	0.05	1.7
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3
Endrin	0.10	3.3
Endrin Aldehyde	0.10	3.3
Endrin Ketone	0.10	3.3
Heptachlor	0.05	1.7
Heptachlor Epoxide	0.05	1.7
Methoxychlor	0.50	17.0
Toxaphene	5.0	170.0
NYSDEC ASP TCL - PCBs (by 2001-3)		
Aroclor-1016	1.0	33.0
Aroclor-1221	2.0	67.0
Aroclor-1232	1.0	33.0
Aroclor-1242	1.0	33.0
Aroclor-1248	1.0	33.0
Aroclor-1254	1.0	33.0
Aroclor-1260	1.0	33.0

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TAL Metals and Cyanide (by CLP-M)		
Aluminum	200	
Antimony	60	
Arsenic	10	
Barium	200	
Beryllium	5	
Cadmium	5	
Calcium	5000	
Chromium	10	
Cobalt	50	
Copper	25	
Iron	100	
Lead	3	
Magnesium	5000	
Manganese	15	
Mercury	0.2	
Nickel	40	
Potassium	5000	
Selenium	5	
Silver	10	
Sodium	5000	
Thallium	10	
Vanadium	50	
Zinc	20	
Cyanide	10	

NOTES:

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.

2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Remedial Design Work Plan (which will include this information) will take precedence.

APPENDIX B

FIGURES

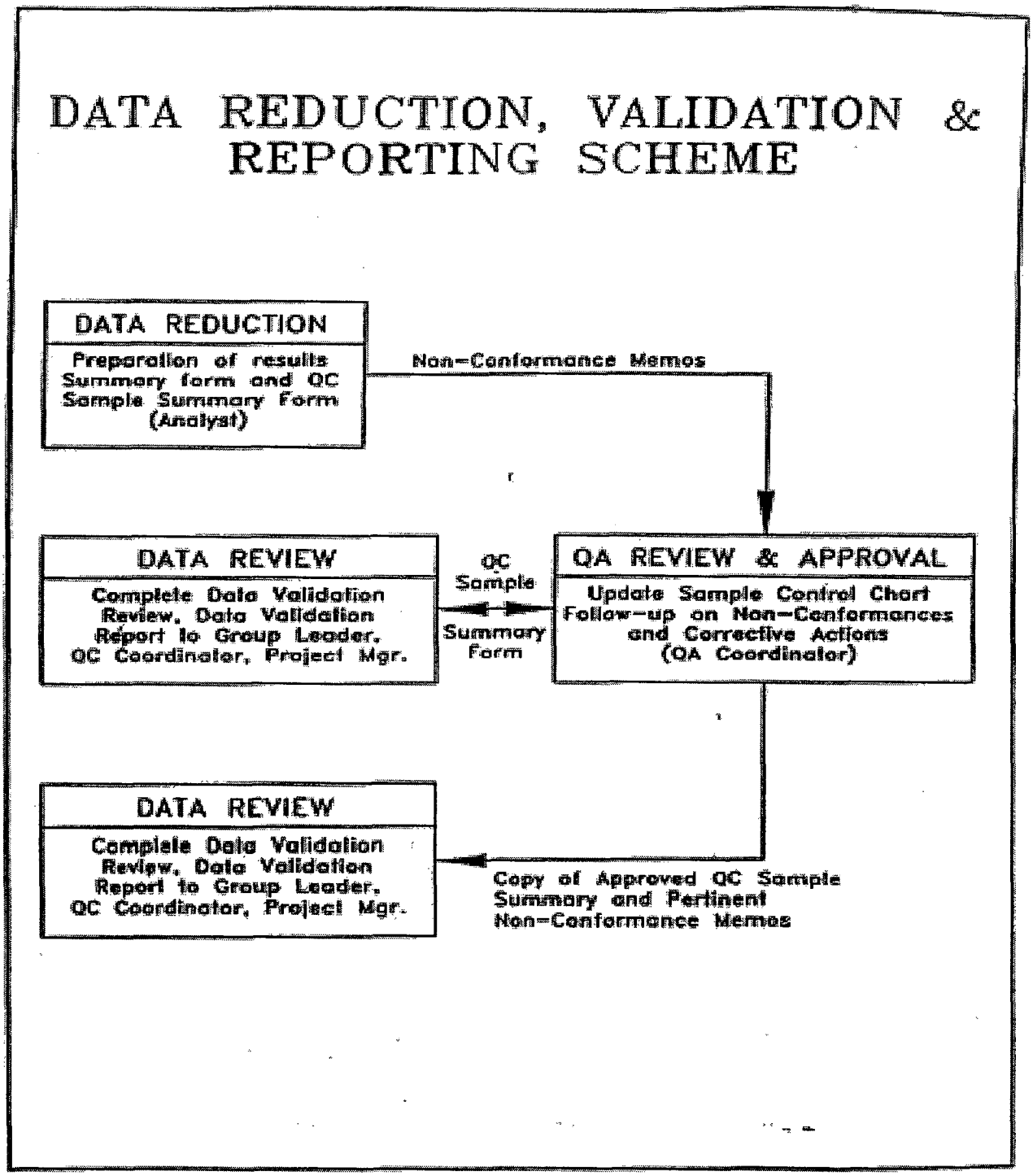


Figure 2 - Data Reduction, Validation and Reporting

Figure 3 – Sample Custody

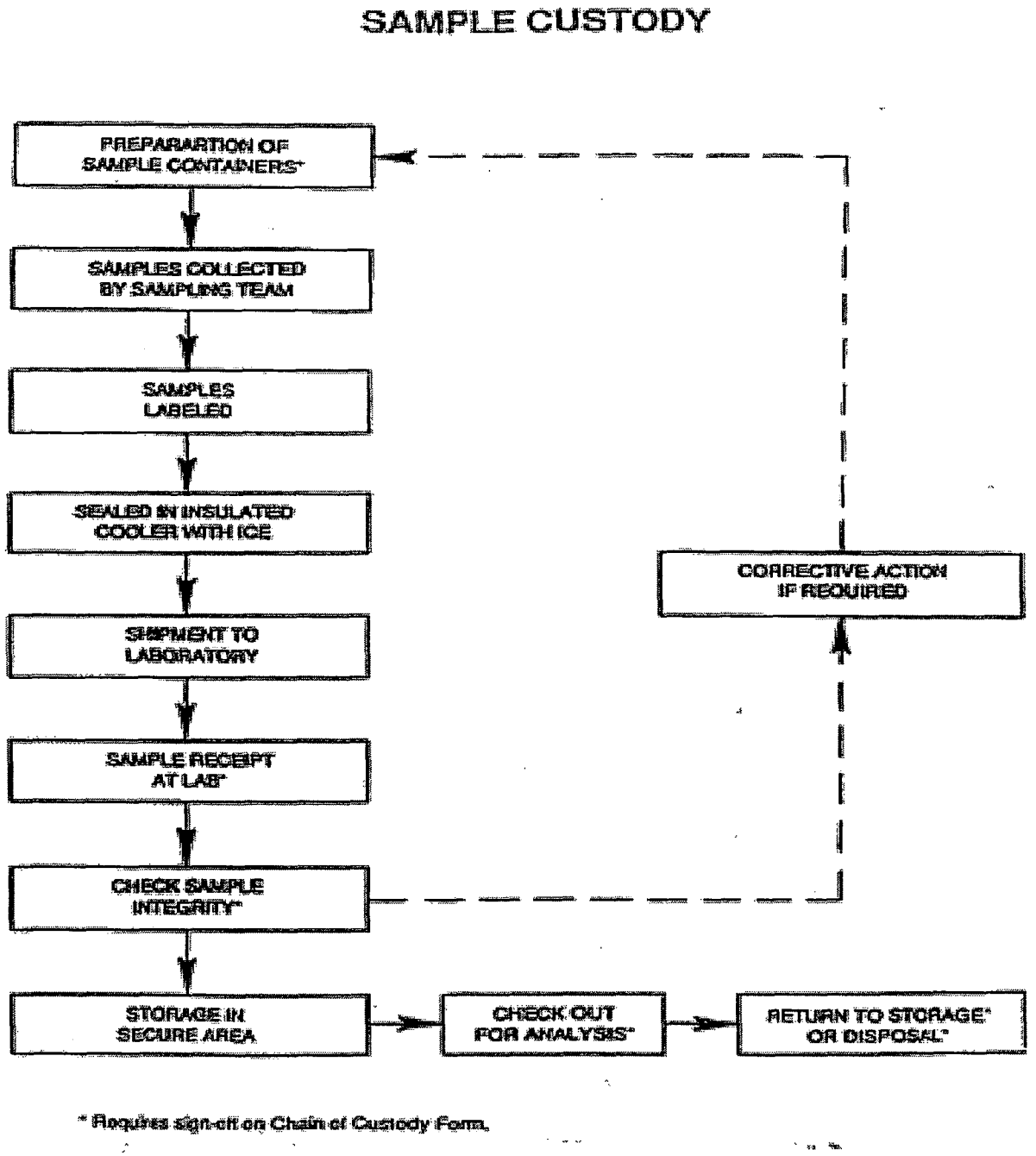
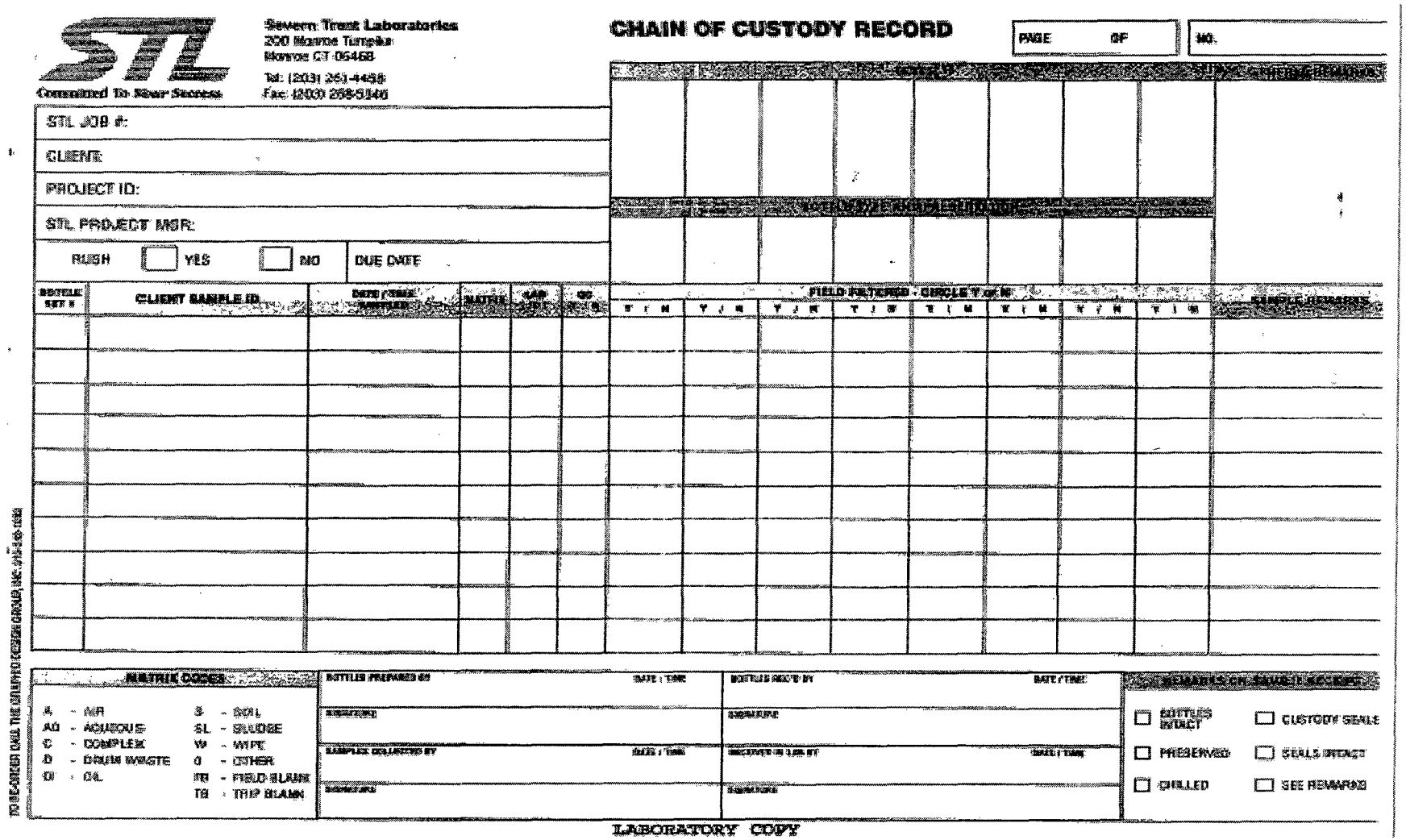


Figure 4 – Sample Chain of Custody Form



Severn Trent Laboratories
200 Monroe Turnpike
Monroe CT 06468
Tel: (203) 261-4458
Fax: (203) 268-8148
Committed To Your Success

CHAIN OF CUSTODY RECORD

PAGE OF NO.

STL JOB #:
CLIENT:
PROJECT ID:
STL PROJECT MGR:
RUSH YES NO DUE DATE

BOTTLE SET # | CLIENT SAMPLE ID | DATE / TIME SAMPLED | MATRIX | GRAB | COMP | FIELD FILTERED - CIRCLE Y or N | SAMPLE REMARKS

MATRIX CODES
A - AIR
AQ - AQUEOUS
C - COMPLEX
D - DRUM WASTE
O - OIL
S - SOIL
SL - SLUDGE
W - WIPE
O - OTHER
FB - FIELD BLANK
TB - TRIP BLANK

BOTTLES PREPARED BY / DATE / TIME
BOTTLES RECD BY / DATE / TIME
SAMPLES DELIVERED BY / DATE / TIME
RECEIVED IN LAB BY / DATE / TIME

REMARKS ON SAMPLE RECEIPT
BOTTLES INTACT
CUSTODY SEALS
PRESERVED
SEALS INTACT
CHILLED
SEE REMARKS

TO BE RECORDED ONCE THE COMPLETED RECORD IS RECEIVED BY STL

LABORATORY COPY

FIGURE 5

DAILY STATUS AND MONITORING REPORT

Date:_____ **Site Name:**_____

Project Manger:_____ **Project Field Operations Lead:**_____

Description of Field Work Performed:_____

Media	Sample Number	Types of Analyses	Sample Sent to Laboratory (Y/N)	Comments

Means of Sample Shipment to Laboratory? Name and Location of Laboratory:

Issues/Concerns Raised:

Work to be Performed Tomorrow:

Name of Preparer:_____

CORRECTIVE ACTION REQUEST	CAR NO. _____ DATE _____
PROJECT NO./TITLE _____ TASK NO./TITLE _____	REFERENCE(S) REPLY DUE DATE
SUBJECT _____	PREPARED BY
DESCRIPTION OF CONDITION	APPROVED BY PROJECT MANAGER
CAUSE AND CORRECTIVE ACTION (Include Effective Date)	
TASK MANAGER DATE	PROJECT QA OFFICER DATE / PROJECT MANAGER DATE
CLOSEOUT ACTION	
PROJECT QA OFFICER DATE	PROJECT MANAGER DATE / SEE REVERSE SIDE FOR INSTRUCTIONS

Figure 6 – Corrective Action Request Form

APPENDIX C

SITE-SPECIFIC HEALTH AND SAFETY PLAN

SITE SPECIFIC HEALTH AND SAFETY PLAN

FOR

KeySpan Greenpoint LNG Plant Facility
Site Investigation

Brooklyn, New York

August 2004

PAULUS, SOKOLOWSKI AND SARTOR ENGINEERING, PC (PS&SPC), PS&S SUBCONTRACTORS, AND THE KEYSPAN CORPORATION DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

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TABLE OF CONTENTS

Section Description **Page No.**

TABLES

APPENDICES

EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations, contact should first be made with the Site Manager who will notify emergency personnel who will in turn contact the appropriate response teams. This emergency contact list must be in an easily accessible location at the site.

Contingency Contacts	**Phone Number**
Police/Fire	911
Poison Control Center:	(800) 343-2722
NYSDEC Spill Hotline:	(800) 457-7362
CHEMTREC	(800) 424-9300
Consolidated Edison Co. (electric service)	(800) 752-6633
Water/Sewer	(212) 639-9675
Gas Operations (KeySpan)	(718)-643-4050
Medical Emergency	
Woodhull Medical Center	(718) 963-8000
Ambulance	911

ROUTE TO HOSPITAL:

The directions to the hospital and a route map from the site may be found in Appendix F. Travel time from the site is approximately 6 minutes.

Emergency Contacts

PS&S Project Manager Joseph Walsh	(732) 584-0227 (office) (732) 221-3157 (cell)
KeySpan Project Manager: Tracey Bell	(718) 403-3053
KeySpan Field Manager Andrew Prophete	(718) 403-1048

LNG Plant Manager
Greg Schneller (718) 963-5463

1.0 INTRODUCTION

1.1 Purpose and Requirements

This Health and Safety Plan (HASP) addresses the health and safety practices that will be employed by all site workers participating in the site investigation to be conducted at the KeySpan Energy (KeySpan) Liquefied Natural Gas (LNG) plant in Greenpoint, Brooklyn, New York. The investigation is designed to support the proposed replacement of the natural liquefaction system at the KeySpan Greenpoint LNG Plant. The LNG is part of the larger Greenpoint Facility which houses several support and energy facilities.

The HASP takes into account hazards generally inherent to the site and presents requirements to be followed by all project personnel in order to avoid and, if necessary, protect against health and/or safety hazards. Activities performed under this HASP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926. Modifications to the HASP may be made with the approval of the Project Manager using the Field Change Request Form found in Appendix A. This plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted at hazardous waste sites.

The provisions of this Plan are mandatory for all on-site project personnel and all project personnel shall abide by this plan. Personnel who engage in project activities must be familiar with this plan and comply with its requirements. All project personnel must sign off on the Plan Acceptance Form (Appendix A) prior to beginning work on the site.

1.2 Site Description

The Greenpoint Facility is located at 287 Maspeth Avenue, Brooklyn, New York. The site is identified on the New York State Department of Environmental Conservation's (NYSDEC) list of known Manufactured Gas Plant (MGP) sites. Based on historical maps, the structures related to the former MGP plant were known to occupy a majority of the current Greenpoint Facility, with the exception of the current LNG Plant area. A small oil unloading pump house at the intersection of Lombardy Street and the Newtown Creek is the only structure noted on the maps in the LNG area. Other uses of this area are not known.

Major structures associated with the Greenpoint Facility gas works include condensers, a generator house, purifier boxes, oil tanks, tar tanks, scrubbers, separators, ovens and holders. The area proposed for investigation has no known historical significance for the gas works plant except for previously mentioned oil unloading pump house in the northeast corner of the Facility site.

The proposed facility expansion includes the construction of an extension (approximately 125 feet by 45 feet) to the existing Control Building, the construction of a new LNG Plant Area Building (approximately 110 feet by 75 feet) and the installation of approximately 500 linear feet of overhead piping. The expansion is located in the extreme northeastern portion of the Greenpoint Facility in an area bounded by Lombardy Street and Newtown Creek.

1.3 Scope of Work

The site investigation tasks covered by this HASP include:

- Installation of soils borings to a depth corresponding with the expected layer of glacial lacustrine deposits (i.e., approximately 50 feet below grade surface (bgs)). The soils borings will be installed via direct push sampling with a GeoProbe rig. The first five of each soil boring will be manually excavated.
- Collection of soil samples from the borings for laboratory analysis to confirm the presence/absence of contamination.
- Installation and development of five (5) groundwater monitoring well clusters (both shallow and deep), if applicable, using Hollow Stem Auger (HSA) drilling methods. Two monitoring well clusters will be located upgradient of the LNG replacement area, and the remaining three (3) well clusters will be located downgradient of the replacement area.
- Collection of groundwater samples for laboratory analysis.
- Installation of two (2) test trenches to evaluate the presence and extent of volatile organic compounds in the breathing zone and the downwind edge of the work zone.

1.4 Project Team Organization

This section specifies the PS&S Project Organization.

1.4.1 Project Manager (PM)

The PM responsibilities include:

- Ensuring the development and implementation of the HASP;
- Ensuring that the Site Manager is informed of project changes which require modifications to the HASP; and
- Responsibility for overall project health and safety.

1.4.2 Site Manager

The Site Manager responsibilities include:

- Ensuring that all site personnel comply with the HASP;
- Ensuring that field work is scheduled with adequate personnel and equipment resources to complete the job safely;
- Ensuring that adequate telephone communication between field crews and emergency response personnel is maintained;
- Enforcing site health and safety rules;
- Conducting EHS activities specified in site HASP, as assigned;
- Identifying operational changes which require modifications to the site HASP;

- Ensuring that plan modifications are documented and are approved by the PM;
- Ensures that proper personal protective equipment is utilized by field teams;
- Monitors compliance with this HASP;
- Notifies PM of all accidents/incidents;
- Determines upgrade or downgrade of personal protective equipment (PPE) based on site conditions and/or real-time monitoring results;
- Ensures that monitoring instruments are calibrated; and
- Maintains health and safety field log books.

1.4.3 Site Personnel

- Site personnel will report any unsafe or potentially hazardous conditions to the Site Manager;
- Site personnel will maintain knowledge of the information, instructions, and emergency response actions contained in this HASP; and
- Site personnel will also comply with requirements set forth in this HASP, including any revisions.

2.0 RISK ANALYSIS

2.1 Chemical Hazards

The characteristics of compounds at typical Manufactured Gas Plant Sites are discussed below for information purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below. Compounds that may potentially be encountered while conducting field tasks at the site include polyaromatic hydrocarbons (coal tar/pitch volatiles), benzene, toluene, ethyl benzene, xylene and phenols. Table 2-1 contains basic chemical data for these contaminants of concern.

Polyaromatic hydrocarbons (PAHs) potentially present at the site may occur in the form of coal tar pitch volatiles and naphthalene. These compounds generally have a depressant effect on the Central Nervous System (CNS), may cause chronic liver and kidney damage, and some are suspected human carcinogens. Acute exposure may include headache, dizziness, nausea, skin and eye irritation.

Repeated exposure to coal tar/pitch volatiles has been associated with an increased risk of developing bronchitis as well as cancer of the lungs, skin, bladder and kidneys. Although the causative agent or agents responsible for the increased cancer risk are not known, numerous PAHs, such as benzo(a)pyrene, have been implicated. In addition to the cancer risk, coal tar pitch volatiles can cause contact dermatitis and ultraviolet light (as in sunlight) sensitivity.

Volatile organic compounds (VOCs), consisting primarily of benzene, toluene, ethyl benzene and xylene (BTEX) may be present on site as a result of by-product generation from gas production. These compounds generally have a depressant effect on the central nervous system, may cause chronic liver and kidney damage and some are suspected human carcinogens. Acute exposure symptoms may include headaches, dizziness, nausea and skin and eye irritation. The primary routes of exposure are inhalation, ingestion and skin adsorption. Symptoms of exposure include dermatitis and bronchitis.

Symptoms of acute exposure to benzene include irritation to eyes, skin, nose and respiratory system, giddiness, headache and nausea. Symptoms of chronic exposure include bone marrow depression and leukemia. Benzene is a known human carcinogen. Symptoms of acute exposure to toluene include irritation to the eyes and nose, fatigue, weakness, confusion, dizziness, headache and dermatitis. Symptoms of chronic exposure include liver and kidney damage. Symptoms of acute exposure to ethyl benzene include eye, skin and mucous membrane irritation, headache, dermatitis and narcosis. Symptoms of acute exposure to xylene include irritation of the eyes, skin, nose and throat, dizziness, drowsiness, lack of coordination, nausea and vomiting. Symptoms of acute exposure to xylene include irritation to the eyes, skin, nose and throat, dizziness, drowsiness, lack of coordination, nausea and vomiting. Symptoms of chronic exposure include liver and kidney damage.

Phenols are predominantly an exposure hazard via skin contact and through inhalation of particulate matter containing phenols. Acute exposure symptoms may include irritation of the eyes, nose and throat as well as skin rash/burns.

Liquefied Natural Gas (LNG) is typically contains greater than 95% methane. Methane is a simple asphyxiant that acts to displace oxygen in the environment. The most significant hazard is inhalation of oxygen deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness and nausea.

In addition to the chemical hazards existing at the site, additional chemical hazards may be present due to materials being brought to the site, such as acids/organic compounds, and decontamination fluids. Prior to working with these materials on-site, Material Safety Data Sheets (MSDS) should be reviewed by all potentially affected personnel.

2.2 Physical Hazards

Most safety hazards are discussed in the Activity Hazard Analyses (AHA) in Appendix E for the different phases of the project.

2.2.1 Temperature Extremes

Site activities may take place during time periods where exposure to temperature extremes could occur. In order to minimize exposure to temperature extremes, site personnel shall be familiar with the health effects of exposure to temperature extremes and the control measures that can minimize exposure.

2.2.2 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps and generators. Excessive noise can destroy the ability to hear, and also put stress on other parts of the body. There is no cure for the effects of noise, so prevention of excessive noise exposure is the only way to avoid health damage. Studies have indicated that high levels of noise will increase the release of adrenaline, resulting in increased heart rate, and blood pressure and respiration levels. Muscles are also found to tense in response to noise. High levels of noise may also interfere with job performance and also have been blamed for excessive fatigue at the end of the workday. Accident rates are higher in workplaces that have higher noise levels.

2.2.3 Heavy Equipment Operations

Heavy equipment will be used to install soil borings and monitoring wells. Working with or near heavy equipment poses many potential hazards, including electrocution, fire/explosion, being struck by or against, or pinched/caught/crushed by, and can result in serious physical harm.

2.2.4 Hand and Power Tool Usage

In order to complete the various tasks for the project, hand and power tools may be utilized. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution.

2.2.5 Fire and Explosion

The use of heavy equipment, diesel generators and motors, steam cleaners and tools that are gasoline powered, all present the possibility of fire and explosion hazards. Prior to the start of any work, all underground utilities and piping that may pose a potential hazard will be identified. In the event a pipe or line is struck, work will stop and the emergency response plan will be implemented. Additionally, diesel fuel and gasoline shall be stored in metal cans with self-closing lids and flash arrestors.

TABLE 2-1
CHEMICAL DATA

COMPOUND	CAS#	ACGIH TLV	OSHA PEL	ROUTE OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Benzene	71-43-2	0.5 ppm, (Skin) 2.5 ppm STEL	1.0 ppm, (Skin) 5 ppm STEL	Inhalation Ingestion Absorption Skin Contact	Irritates eyes, skin, nose, resp. syst.; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow	Eyes, skin, blood, CNS, bone marrow, respiratory system	Liquid with an aromatic odor VP= 75 mm IP= 9.24eV
Coal tar pitch volatiles (CTPV)	65996-93-2	0.2 mg/m3	0.2 mg/m3	Inhalation Skin contact	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory, CNS, liver, kidneys, skin, bladder	Colorless/ pale green, solid, faint aromatic odor
Ethyl benzene	100-41-4	100 ppm	100 ppm	Inhalation Skin Contact Ingestion	Irritates eyes, skin, mucous membranes; headache; dermatitis; narcosis, coma.	Eyes, skin, resp. system, CNS	VP= 7 mm, aromatic odor, IP= 8.76 eV
Phenol	108-95-2	5 ppm (Skin)	5 ppm (Skin)	Inhalation Absorption Ingestion Skin Contact	Irritates eyes, nose, throat; anorexia; weakness, muscle ache; dark urine; cyanosis; liver & kidney damage; skin burns, dermatitis; convulsions.	Eyes, skin, respiratory system, liver, kidneys	Crystalline solid with a sweet, acrid odor. VP= 0.4 mm IP= 8.50 eV
Toluene	108-88-3	50 ppm (skin)	200 ppm 300 ppm (C) 500 ppm (10 min max peak)	Inhalation Absorption Ingestion Skin Contact	Irritates eyes and nose, fatigue, weakness, confusion, euphoria, dizziness; headache, dilated pupils, lacrimation, nervousness, muscular fatigue, insomnia, paresthesia, dermatitis, liver and kidney damage	Liver, eyes kidneys, resp syst. skin, CNS	Colorless liquid with a sweet, pungent, benzene-like odor. VP= 21 mm IP= 8.82eV
Xylene	1330-20-7	100 ppm, 150 ppm (STEL)	100 ppm	Inhalation Absorption Ingestion Skin Contact	Irritates eyes, nose, throat, and skin; dizziness, drowsiness, staggered gait, nausea, anorexia, vomiting, abdominal pain, dermatitis	Eyes, skin, resp. system, GI tract, CNS, blood, liver, kidneys	Colorless liquid with an aromatic odor VP = 79 mm IP= 8.56 eV
Naphthalene	91-20-3	10 ppm	10 ppm	Inhalation Ingestion Skin contact	Irritates the eyes, headache, nausea, fatigue; renal shutdown, optical neuritis	Eyes, skin, blood, liver, CNS, kidneys	VP: 0.08 IP: 8.12 eV Mothball odor
Hydrogen cyanide	74-90-8	4.7 ppm (5 mg/m^3) STEL [skin]	10 ppm (11 mg/m^3) [skin]	Inhalation Ingestion Absorption Skin/Eye Contact	Asphyxia; weakness, headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes	CNS, CVS, thyroid, blood	Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. VP: 630 mmHg IP: 13.60 eV

COMPOUND	CAS#	ACGIH TLV	OSHA PEL	ROUTE OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/Eye Contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, CNS	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm IP: 10.46 eV
Methane	74-82-8	1000 ppm[1]	NA	Inhalation	Respiratory difficulty, headache, dizziness and nausea	Respiratory system, CNS	Odorless, colorless gas Simple asphyxiant; displaces oxygen.

Abbreviations

C = ceiling limit, not to be exceeded
CNS = Central Nervous System
CVS= Cardiovascular System
eV = electron volt
FP = Flash point
IP = Ionization Potential
mm = millimeter
ppm = parts per million
Skin = significant route of exposure
STEL = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure approximately 68° F in mm Hg (mercury)

[1] TWA for Aliphatic hydrocarbon gases.

2.2.6 Slips, Trips, and Falls

Working in and around the site may pose slip, trip and fall hazards due to potentially slippery surfaces and uneven terrain. Fall hazards are also anticipated to be present during monitoring well and soil boring installation. Additionally, fall hazards may be present during the completion of improvements to the bulkhead. Potential adverse health effects include injuries from a fall to the ground and becoming seriously injured.

2.2.7 Manual Lifting

Manual lifting of heavy objects will be required for several tasks. Not following proper lifting techniques can result in back injuries and strains. Back injuries are a serious concern as they are the most common workplace injury, often resulting in lost or restricted work time, and long treatment and recovery periods.

2.2.8 Steam, Heat and Splashing

Exposure to steam/heat/splashing hazards can occur during steam cleaning operations. Exposure to steam/heat/splashing can include scalding/burns, eye injury, and puncture wounds.

2.2.9 Smoking Policy

Under no circumstances will eating, drinking or smoking or the use of smokeless tobacco or gum be permitted inside an established Exclusion Zone.

2.3 Biological Hazards

During the course of the project, there is a potential for workers to come into contact with biological hazards such as animals, insects and plants. The Activity Hazard Analysis found in Appendix E will include specific hazards and control measures for each task.

2.3.1 Animals

During site operations, animals such as dogs, cats, mice and snakes may be encountered. Workers shall use discretion and avoid all contact with animals. If these animals present a problem, efforts will be made to remove these animals from the site by contacting a licensed pest control technician.

2.3.2 Insects

Insects, such as mosquitoes, ticks, bees and wasps may be present during certain times of the year. Workers will be encouraged to wear repellents when working in areas where insects are expected to be present. If insects are prevalent, efforts will be made to remove them from the site by contacting a licensed pest control technician.

2.3.2.1 Lyme Disease

Lyme disease is caused by infection from a deer tick that carries a spirochete, a spiral-shaped bacterium. During the painless tick bite, the spirochete may be transmitted into the bloodstream, which could lead to the worker contracting Lyme disease.

Lyme disease may cause a variety of medical conditions including arthritis, which can be treated successfully if the symptoms are recognized early and medical attention is received. Treatment with antibodies has been successful in preventing more serious symptoms from developing. Early signs may include a flu-like illness, an expanding skin rash and joint pain. If left untreated, Lyme disease can cause serious nerve or heart problems as well as a disabling type of arthritis.

Symptoms can include a stiff neck, chills, fever, sore throat, headache, fatigue and joint pain. This flu-like illness is out of season, commonly happening between May and October when ticks are most active. A large expanding skin rash usually develops around the area of the bite. More than one rash may occur. The rash may feel hot to the touch and may be painful. Rashes vary in size, shape, and color, but often look like a red ring with a clear center. The outer edges expand in size. It's easy to miss the rash and the connection between the rash and a tick bite. The rash develops from three days to as long as a month after the tick bites. Almost one third of those with Lyme disease never get the rash.

Joint or muscle pain may be an early sign of Lyme disease. These aches and pains may be easy to confuse with the pain that comes with other types of arthritis. However, unlike many other types of arthritis, this pain seems to move or travel from joint to joint.

Lyme disease can affect the nervous system. Symptoms include stiff neck, severe headache, and fatigue usually linked to meningitis. Symptoms may also include pain and drooping of the muscles on the face, called Bell's Palsy. Lyme disease may also mimic symptoms of multiple sclerosis or other types of paralysis.

The disease can also cause serious but reversible heart problems, such as irregular heartbeat. Finally, Lyme disease can result in a disabling, chronic type of arthritis that most often affects the knees. Treatment is more difficult and less successful in later stages. Often, the effects of Lyme disease may be confused with other medical problems.

It is recommended that personnel check themselves when in areas that could harbor deer ticks, wear light color clothing and visually check themselves and their site personnel when coming from wooded or vegetated areas. If a tick is found biting an individual, the PM should be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. The affected area should then be disinfected with an antiseptic wipe. The employee will be offered the option for medical treatment by a physician, which typically involves prophylactic antibiotics. If personnel feel sick or have signs similar to those above, they should notify the PM immediately.

2.3.3 West Nile Virus

West Nile Virus (WNV) is a mosquito-borne infection that can cause encephalitis. Since the initial outbreak in 1999, the virus has spread rapidly throughout New York State. There are about 65 different species of mosquitoes in New York State, but only a small percentage have been associated with WNV. Most mosquitoes are not infected and the chance of infection from a mosquito bite of an on-site worker is very small. All residents of areas where virus activity has been identified are at risk of getting WNV, but those at highest risk for becoming seriously ill from WNV are people over 50.

The following precautions will be used to help reduce the risk of mosquito bites:

- Reduce mosquito-breeding areas by making sure that wheelbarrows, buckets, and other containers are turned upside down when not being used so that they do not collect standing water.

- Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many mosquitoes are most active (between dusk and dawn).

- Use mosquito repellent according to label directions when outdoors for long periods of time and when mosquitoes are most active.

2.3.4 Plants

Plants such as poison ivy, poison oak, and poison sumac may be prevalent at the site during certain times of the year. Poison ivy can be found as vines on tree trunks or as upright bushes. Poison ivy consists of three leaflets with notched edges. Two leaflets form a pair on opposite sides of the stalk, and the third leaflet stands by itself at the tip. Poison ivy is red in the early spring and turns shiny green later in the spring. Poison sumac can be present in the form of a flat-topped shrub or tree. It has fern-like leaves, which are velvety dark green on top and pale underneath. The branches of immature trees have a velvety "down". Poison sumac has white, "hairy" berry clusters. Poison oak can be present as a sparingly branched shrub. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches.

Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. If you believe you have contacted one of these plants, immediately wash skin thoroughly with soap and water, taking care not to touch your face or other body parts.

Employees may wear PPE in order to reduce the potential for exposure. Pre-exposure topical lotions may be applied prophylactically.

3.0 PERSONNEL PROTECTION AND MONITORING

3.1 Medical Surveillance

All site personnel performing field work where potential exposure to contaminants exists at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f). The Site Manager will confirm a physician's medical release for work before an employee can work in the exclusion zone. The examination will be taken annually at a minimum and upon termination of site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the PM in consultation with the Site Manager if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other site conditions warrant further medical surveillance. Copies of all training certifications and medical surveillance examination information will be kept onsite.

3.2 Personal Protective Equipment

The personal protective equipment (PPE) specified in Table 3-1 represents a hazard analysis for PPE selection. Specific information on the selection rationale for each activity can be found under Section 2.0 and Appendix E-Activity Hazard Analyses. For activities not covered by Table 3-1, the Site Manager will conduct the hazard assessment and select the proper PPE . PPE selection will be made in consultation with the PM. A written justification for major downgrades will be provided to the PM for approval on a field change request form.

3.2.1 PPE Abbreviations

HEAD PROTECTION HH = Hard Hat HEARING PROTECTION EP = ear plugs EM = ear muffs	EYE/FACE PROTECTION APR = Full Face Air Purifying Respirator MFS = Mesh Face shield PFS = Plastic Face shield SG = ANSI approved safety glasses with side shields	FOOT PROTECTION Neo = Neoprene OB = Overboot Poly = polyethylene coated boot Rub = rubber slush boots STB = Leather work boots with steel toe.
HAND PROTECTION Cot = cotton But = Butyl LWG = Leather Work Gloves Neo = Neoprene Nit = Nitrile Sur = Surgical	BODY PROTECTION Cot Cov = Cotton coveralls Poly = Polyethylene coated tyvek coveralls Saran = Saranex coated tyvek coveralls Tyvek = Uncoated paper tyvek coveralls WC = Work Clothing	RESPIRATORY PROTECTION Level D = No respiratory protection required Level C = Full face air purifying respirator with OV/HEPA cartridges Level B = Full face air supplied respirator with escape bottle

TABLE 3-1
PERSONAL PROTECTIVE EQUIPMENT SELECTION

TASK	HEAD	EYE/ FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR
Mobilization/demobilization	HH	SG	STB	LWG as needed	WC	EP as needed	Level D
Site Preparation	HH	SG	STB	LWG as needed	WC	EP as needed	Level D
Installation of Soil Borings/Test Pits	HH	SG	STB	LWG	Tyvek	EP as needed	Level D initially, Level C as needed
Soil Sampling	HH	SG	STB, OB	Nit, Sur	Tyvek	EP or EM	Level D initially, Level C as needed
Installation and Development of Groundwater Wells	HH	SG or splash goggles	STB, OB	Nit, Sur	Tyvek	EP as needed	Level D initially, Level C as needed
Groundwater Sampling	HH	SG or splash goggles	STB, OB	Nit, Sur	Tyvek	EP as needed	Level D initially, Level C as needed
Equipment decontamination	HH	PFS with SG or splash goggles	STB, OB	Nit, Sur	WC, Poly	EP as needed	Level D

3.2.2 OSHA Requirements for Personal Protective Equipment

All personal protective equipment used during the course of this field investigation must meet the following OSHA standards:

Type of Protection	Regulation	
Eye and Face	29 CFR 1910.133	ANSI Z87.1-1968
Respiratory	29 CFR 1910.134	ANSI Z88.1-1980
Head	29 CFR 1910.135	ANSI Z89.1-1969
Foot	29 CFR 1910.136	ANSI Z41.1-1967
Hand	29 CFR 1910.138	
Hearing	29 CFR 1910.95	
Protective Clothing	29 CFR 1910.132	

Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.134). Air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency;
- IDLH concentrations;
- High relative humidity; and
- If contaminant levels exceed designated use concentrations.

3.2.3 Respirator Cartridge Change-Out Schedule

A respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. The respirator cartridge change-out schedule for this project is as follows:

- Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first.
- If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.

Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short of time period they were used the day before.
The schedule was developed based on the following scientific information and assumptions:

- Analytical data that is available regarding site contaminants;
- Using the Rule of Thumb provided by the AIHA;
- All of the chemicals have boiling points greater than 70° C;
-

- Total airborne concentration of contaminants is anticipated to be less than 200 ppm;
- The humidity is expected to be less than 85%; and
- Desorption of the contaminants (including those with poor warning properties) after partial use of the chemical cartridge can occur after a short period (hours) without use (e g, overnight) and result in a non-use exposure.

The following is a partial list of factors that may affect the usable cartridge service life and/or the degree of respiratory protection attainable under actual workplace conditions. These factors have been considered when developing the cartridge change-out schedule:

- Type of contaminant(s)
- Contaminant concentration
- Relative humidity
- Breathing rate
- Temperature
- Changes in contaminant concentration, humidity, breathing rate and temperature
- Mixtures of contaminants
- Accuracy in the determination of the conditions
- The contaminant concentration in the workplace can vary greatly. Consideration must be given to the quality of the estimate of the workplace concentration
- Storage conditions between multiple uses of the same respirator cartridges. It is recommended that the chemical cartridges be replaced after each work shift. Contaminants adsorbed on a cartridge can migrate through the carbon bed without airflow.
- Age of the cartridge
- Condition of the cartridge and respirator
- Respirator and cartridge selection Respirator fit
- Respirator assembly, operation, and maintenance
- User training, experience and medical fitness
- Warning properties of the contaminant
- The quality of the warning properties should be considered when establishing the chemical cartridge change schedule. Good warning properties may provide a secondary or back-up indication for cartridge change-out.

3.3 Monitoring Requirements

3.3.1 Work Zone Air Monitoring

The following monitoring instruments will be available for use during field operation as necessary:

- Photoionization Detector (PID), Photovac Microtip with 10.6 eV probe or equivalent; or
- Flame Ionization Detector (FID), Foxboro OVA model 128 or equivalent; and
- Colorimetric detector tube for Benzene and Hydrogen Cyanide; and
- Dust Meter, MIE Miniram model PDM-3 or equivalent; and
- Combustible Gas Indicator (CGI), Oxygen (O_2), H_2S meter, Carbon Monoxide (CO) meter, MSA model 361 or equivalent.

All air monitoring equipment will be calibrated and maintained in accordance with Appendix D. During intrusive operations (i.e., installation of soil borings, test pits and groundwater monitoring wells), organic vapor concentrations shall be measured continuously. During any other activities that may generate organic vapors, monitoring shall be conducted at least once every thirty minutes. Organic vapor concentrations shall be measured upwind of the work site to determine background concentrations at least twice a day (i.e., once in the morning and once in the afternoon).

Colorimetric detector tubes will be used to determine the potential presence of benzene and hydrogen cyanide when action levels found in Table 3-2 have been exceeded.
A dust meter will be used to measure airborne particulate matter during intrusive activities. Monitoring will be continuous and readings will be averaged over a 15-minute period for comparison with the action levels.

A CGI/O_2 meter shall be used to monitor for combustible gases and oxygen content within the borehole/test pit and surrounding areas and elsewhere as necessary.

The National Institute for Occupational Safety and Health (NIOSH) concerning the action levels for work has established guidelines in a potentially explosive environment. These guidelines are as follows:

10% LEL- Limit all activities to those which do not generate sparks.
20% LEL- Cease all activities in order to allow time for the combustible gases to vent.

TABLE 3-2
REAL TIME AIR MONITORING ACTION LEVELS

AIR MONITORING INSTRUMENT	MONITORING LOCATION	ACTION LEVEL	SITE ACTION	REASON
PID/FID	Breathing Zone*	> 0.5 ppm	Use detector tube for benzene and hydrogen cyanide	1/2 of PEL for benzene
PID/FID	Breathing Zone*	0 - 25 ppm, no benzene	No respiratory protection is required	
	Breathing Zone	> 0.5 ppm - 10 ppm with benzene present (Draeger tubes) **or** > 25-100 ppm* no benzene	Don Level C respiratory protection	Maximum allowable concentration for full-face respirator is 10 ppm without quantitative fit test
		>10 ppm- benzene present **or** >100 ppm- no benzene	Stop work, withdraw from work area; notify PM	Air-supplied respiratory protection required.
Oxygen meter	Breathing Zone*	< 19.5%	Stop work; withdraw from work area; notify PM.	Low oxygen
		> 22%	Stop work; withdraw from work area; notify PM.	Oxygen enriched atmosphere; explosion hazard
CGI	Test Pit/Borehole Location	< 10 % LEL	Investigate possible causes, allow excavation to ventilate; use caution during procedures.	Increasing potential for ignition of vapors
		> 10% LEL	Stop work; allow excavation, borehole to ventilate to < 10% LEL; if no decrease to < 10% LEL, withdraw from work area; notify PM.	Potential for ignition of vapors
Dust Meter	Breathing Zone* or Test Pit Location	> 150 ug/m^3	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water	Potential inhalation source for airborne contaminants adhering to dust
		> Background + 100 ug/m^3	Upgrade to Level C PPE, implement additional dust suppression	NYSDEC requirement
H_2S	Breathing Zone*	> 5 ppm – 10 ppm **	No respiratory protection required	
		> 10 ppm **	Leave area and continue monitoring	
HCN	Breathing Zone*	< 2.5 mg/m^3	Level D	Cyanide tube
		≥ 2.5 mg/m^3	Stop work; consult PM	

* Non-transient (sustained reading of greater then 1 minute)
** 5-minute average

3.3.2 Community Air Monitoring Plan

This Community Air Monitoring Plan has been designed to conform with the guidelines presented by the New York State Department of Health in Appendix 1A of the Draft New York State Department of Conservation DER-10 Technical Guidance for Site Investigation and Remediation. Real-time air monitoring for volatile compounds at the perimeter of the exclusion zone will be conducted. Odor suppressant foams and water sprays will be readily available to address dust and odor emissions. The following procedures will be implemented during field activities as appropriate:

- Volatile organic compounds will be monitored at the downwind perimeter of the exclusion zone on a continuous basis. If 15-minute average total organic vapor levels exceed 5 ppm (or 5 ppm above background as determined at an upwind location), excavating activities will be temporarily halted and monitoring continued until total organic vapor levels drop below the action level. If the organic vapor level is above 25 ppm at the perimeter of the exclusion area, activities must be shut down. Monitoring will continue and the Project Manager or designee will be consulted regarding a proper course of action. All 15-minute average readings must be recorded and will be available for NYSDEC and NYSDOH review.
- Particulates may become a concern during intrusive site activities (i.e., grading, excavating or other movement or disturbance of site soils). PM10 particulate levels will be continuously monitored downwind at the perimeter of the exclusion zone with a portable real-time PM10 particulate monitor that will have an alarm set at 100 ug/m3. If downwind particulate levels integrated over a period of 15 minutes exceed 100 ug/m3, then particulate levels upwind of the exclusion zone will be measured. If the downwind particulate level is more than 100 ug/m3 greater than the upwind particulate level, dust suppression techniques (e.g. spraying water, covering exposed soils with poly sheeting) will be employed. If after implementation of dust suppression techniques, the downwind PM10 particulate level exceeds the upwind PM10 particulate level by greater than 150 ug/m3, activities will be halted and the Project Manager will be consulted. All readings will be recorded and be available for NYSDEC and NYSDOH review. These action levels can be modified if particulates are better characterized and identified.

3.3.3 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background levels at the perimeter of the exclusion zone, excavating activities will cease and monitoring continued. If the organic vapor level decreases below 5 ppm (above background), excavating activities may resume. If the organic vapor levels are greater than 5 ppm, but less than 5 ppm over background at the perimeter of the work area, activities may resume provided:

- The organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest residence or commercial structure, whichever is less, is below 5 ppm over background, and,
- More frequent intervals of monitoring, as directed by the Site Manager in consultation with the Project Manager, are conducted.

If the organic vapor level is above 5 ppm over background at the perimeter of the exclusion zone, work activities will halt and odor control contingencies will be implemented. Exposed soils will be covered with poly sheeting or a biodegradable, surfactant-based foam concentrate, will then be sprayed onto the excavated soils to control the fugitive vapors. When work shutdown occurs, downwind air monitoring will be implemented to ensure that vapor emissions do not impact the nearest residential or commercial structure.

If organic vapor levels greater than 5 ppm over background are identified 200 feet downwind from the exclusion zone, or half the distance to the nearest residential or commercial property line, whichever is less, all work must cease. Following cessation of work activities and implementation of odor control contingencies, if organic vapor levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then air quality must be monitored within 20 feet of the perimeter of the nearest residential/commercial structure (the "20 foot zone").

If organic vapor levels approach 5 ppm above background within the "20 foot zone" for a period of more than 30 minutes, or organic vapor levels greater than 10 ppm above background for any time period occur within the "20 foot zone", then the following steps will be taken:

- Frequent air monitoring will be conducted at 30-minute intervals within the 20-foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site Manager.

4.0 WORK ZONES AND DECONTAMINATION

4.1 Site Work Zones

To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, work zones will be delineated at the site. The flow of personnel between the zones should be controlled. The establishment of the work zones will help ensure that: personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency.

4.1.1 Exclusion Zone

Exclusion zones will be established at the site for all intrusive activities; unprotected onlookers should be located 50 feet upwind of intrusive activities. In the event that volatile organics exceed action levels in the breathing zone as discussed in Section 3, all personnel within the exclusion zone must don Level C protection. Exclusion zones will also be established during any activity when Level C protection is established as a result of conditions discussed in Section 3.

All personnel within the exclusion zone will be required to use the specified level of protection. No eating, drinking, or smoking will be allowed in the exclusion or decontamination zones.

4.1.2 Decontamination Zone

If appropriate, a decontamination zone will be established between the exclusion zone and the support zone, and will include the personnel and equipment necessary for decontamination of equipment and personnel (discussed below). Personnel and equipment in the exclusion zone must pass through this zone before entering the support zone. This zone should always be located upwind of the exclusion zone.

4.1.3 Support Zone

The support zone will include the remaining areas of the job site. Break areas, operational direction and support facilities (to include supplies, equipment storage and maintenance areas) will be located in this area. No equipment or personnel will be permitted to enter the support zone from the exclusion zone without passing through the personnel or equipment decontamination station. Eating, smoking, and drinking will be allowed only in this area.

4.2 Decontamination

Due to the low level of contaminants expected, any water used in decontamination procedures will be containerized on-site and sampled before disposal.

4.2.1 Decontamination of Personnel

Consideration will be given to prevailing wind directions so that, if possible, the decontamination line, the support zone, and contamination reduction zone exit is upwind from the exclusion zone and the first station of the decontamination line. Decontamination will be performed by removing all PPE used in EZ and placing in drums/trash cans at CRZ. Baby wipes shall be available for wiping hands and face. Limited personnel decontamination facilities will be established for all activities that have the potential for spreading contamination. The stations may include plastic sheeting, garbage bags, decontamination tubs, brushes and Alconox-type soap. Requirements for decontamination are presented on the following page.

Overboots and/or gloves - no respiratory protection	Chemical protective clothing/Air purifying respiratory	Chemical protective clothing/SCBA
1. Equipment drop	1. Equipment drop	1. Equipment drop
2. Overboot and glove removal.	2. Outer boot and glove wash	2. Outer boot and glove wash
3. Hand/face wash	3. Outer boot and glove rinse	3. Outer boot and glove rinse
	4. Outer boot and glove removal	4. Outer boot and glove removal
	5. Coverall removal/disposal	5. SCBA removal
	6. Respirator removal	6. Coveralls removal
	7. Inner glove removal/disposal	7. Inner glove removal/disposal
	8. Hand/face wash	8. Hand/face wash

4.2.2 Decontamination of Equipment

Equipment will be decontaminated as follows:

- Heavy equipment will be decontaminated using high-pressure steam or water to remove gross contamination.
- Surface equipment, such as field meters and surveying instruments, will be either steam cleaned or cleaned with a detergent wash and wiped with a clean, damp cloth.

5.0 ACCIDENT PREVENTION AND CONTINGENCY PLAN

5.1 Accident Prevention

All field personnel will receive health and safety training prior to the initiation of any site activities. All personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, regular meetings should be held. Discussion should include:

- Tasks to be performed
- Time constraints (e.g., rest breaks, cartridge changes)
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals
- Emergency procedures

A copy of the site Work Rules may be found in Appendix C and shall be posted in a conspicuous location.

5.2 Contingency Plan

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential.

5.2.1 Responsibilities

5.2.1.1 Project Manager (PM)

The PM oversees and approves the Emergency Response/Contingency Plan. The PM acts as a liaison to applicable regulatory agencies.

5.2.1.2 Emergency Coordinator

The Emergency Coordinator (EC) is the **Site Manager**. The EC shall locate emergency phone numbers and identify hospital routes prior to beginning work on site. The EC shall make necessary arrangements to be prepared for any emergencies that could occur. The EC shall also coordinate with KeySpan management to ensure that the procedures contained herein do not conflict with the facility's emergency program. The EC shall implement the Emergency Response/Contingency Plan whenever conditions at the site warrant such action. The coordinator will be responsible for prior coordination of the emergency treatment and emergency transport of site personnel as necessary, and notification of emergency response units and the appropriate management staff.

The EC is responsible for seeing that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order

or evacuation. The EC is required to immediately notify the PM of any fatalities or catastrophes.

5.2.1.3 Site Personnel

Site personnel are responsible for knowing the Emergency Response/Contingency Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of impending or actual emergencies, and to cooperate fully once the Plan is enacted. All information obtained about an emergency shall be immediately communicated to the Emergency Coordinator.

5.2.2 Communications

A variety of communication systems may be utilized during emergency situations. These are discussed in the following sections.

5.2.2.1 Telephone Communications

The primary form of communication during an emergency between the site and outside emergency response groups will be telephone communications. The location of a site cell phone or the nearest telephone shall be determined and all site personnel shall be made aware of its location and use prior to the start of site operations.

5.2.2.2 Air Horns

Air horns may be used to alert site personnel of emergencies. The following signals will be used:

- Two short blasts - shut down equipment, clear radio channels, await instructions
- Three short blasts - injured employee, first-aid providers respond
- One continuous blast - site evacuation

Air horns should be placed at the support area and with each field team. The procedure to activate the air horns consists of depressing the air horn button or switch while pointing it in the direction of the area to be signaled. Air horns should be tested at least monthly to ensure that they are working properly.

5.2.2.3 Hand Signals

Field teams along with the site personnel system shall use hand signals. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breathe
Grip on a partner's wrist or placement of both hands around a partner's waist	Leave the area immediately, no debate
Hands on top of head	Need assistance
Thumbs up	Okay, I'm all right, I understand
Thumbs down	No, negative

5.2.3 Emergency Equipment

The following emergency equipment shall be available at the site:

- 5 lb. ABC fire extinguisher;
- Industrial size first aid kit; and
- Portable eyewash with 15-minute flushing capability or equivalent potable water source.

5.2.4 Evacuation

Under certain circumstances, it may become necessary for all personnel to leave the site for a time period. Such circumstances may include violent storms, explosion or fire. When it is determined that an evacuation is warranted, the Emergency Coordinator shall issue an evacuation command. At this time, all site personnel shall terminate current operations in an orderly fashion as is practicable, perform decontamination procedures (if possible), and proceed to the pre-determined assembly location.

5.2.5 Potential Emergency Situations and Procedures

5.2.5.1 Potential or Actual Fire or Explosion

In the event of a fire or explosion:

Site Personnel shall:

- Immediately stop work;
- Decontaminate (if possible); and
- Immediately evacuate the site, proceed to the pre-determined assembly point.

The **Emergency Coordinator** shall immediately notify the facility liaison (if applicable), and other appropriate emergency response groups if an actual fire or explosion has taken place.

5.2.5.2 Personnel Injury

In the event of a personnel injury:

Site Personnel shall:

- Apply first aid as appropriate;
- Decontaminate the victim to the greatest extent possible;
- Transport the victim to the support zone (if the victim is unable to walk); and
- Inform the PM of the accident/incident.

The **Emergency Coordinator** shall contact emergency medical services. The ambulance/rescue squad shall be contacted for transportation to the hospital as necessary in an emergency situation. However, since some situations may require

transport of an injured party by other means, a hospital route shall be developed by the EC prior to the startup of operations. The map will be drawn for each site and posted in the field team vehicle. Only in **non-emergency** situations shall an injured person be transported to the hospital by means other than an ambulance.

5.2.5.3 Overt Personnel Exposure

Situations may arise when personnel are overtly exposed to chemical hazards via inhalation, skin contact or ingestion. In the event of an overt personnel exposure:

Site Personnel shall follow these procedures:

For Skin Contact

- Use copious amounts of soap and water;
- Wash/rinse affected area thoroughly; and
- Apply appropriate first aid.

For Eye Contact

- Begin using emergency eyewash;
- Call for a vehicle to transport the victim; and
- Transport immediately to SZ, **do not** decontaminate.

For Inhalation

- Move to fresh air.

For Ingestion

- Determine, if possible, what chemical was ingested;
- Contact the poison control center;
- Follow poison control center guidelines; and
- Decontaminate and transport to emergency medical facility.

For a Puncture Wound or Laceration

- Apply appropriate first aid; and
- If necessary, decontaminate and transport to emergency medical facility.

The **Emergency Coordinator** shall:

- Contact outside emergency services immediately for eye contact and ingestion; and
- Contact the poison control center regarding ingestion as soon as possible.

5.2.5.4 Adverse Weather Conditions

Site activities will be limited to daylight hours unless adequate lighting is provided. All site activities will be limited to acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate, if necessary, in case of inclement weather conditions.

In the event of adverse weather conditions, the Site Manager or designee will determine if work can continue without jeopardizing the health and safety of the workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries
- Potential for cold stress and cold-related injuries
- Treacherous weather-related working conditions
- Limited visibility
- Potential for electrical storms.

The Site Manager will monitor weather service advisories to determine when other adverse weather conditions may develop. These conditions may include tornadoes, electrical storms, thunderstorms, hurricanes, and snowstorms. When it is indicated that the safety of personnel at the site may be at risk, the Site Manager shall make a determination whether or not to continue work.

5.2.6 Restoration and Salvage

After an emergency, prompt restoration of fire protection equipment, medical supplies, and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Re-filling fire extinguishers;
- Re-filling medical supplies; and
- Re-filling or replacing eyewash containers.

5.2.7 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

1. Program Manager; Bruce McClellan- 732-584-0685
2. Project Manager; Joe Walsh – 732-584-0227

For reporting purposes, the term accident refers to fatalities, all injuries (even first aid cases only), spill or exposure to hazardous materials (radioactive materials, toxic materials, explosive or flammable materials), fire, explosion, property damage, or potential occurrence of the above.

6.0 TRAINING

The Site Manager will obtain copies of all project personnel's training certifications and medical surveillance examination information, which will be kept onsite throughout the duration of the project.

6.1 General Health and Safety Training

Pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

6.1.1 Three Day Supervised on the Job Training

In addition to the required initial hazardous waste operations training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

6.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 1910.120 requirements.

6.3 Supervisory Training

Supervisors and health and safety personnel shall have completed an additional eight hours of specialized training in accordance with 29 CFR 1910.120.

6.4 Site-Specific Training

The Site Manager will be responsible for developing a site-specific occupational hazard training program and providing training to all personnel that are to work at the site. Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. At a minimum, this training shall consist of the following topics:

- Names of personnel responsible for site safety and health;
- Safety, health, and other hazards at the site;
- Proper use of personal protective equipment;
- Work practices by which the employee can minimize risk from hazards;

- Safe use of engineering controls and equipment on the site;
- Acute effects of compounds at the site; and
- Decontamination procedures.

6.5 On-Site Safety Briefings

Project personnel and visitors will be given on-site health and safety briefings on a daily basis by the Site Manager to assist site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity to periodically update the crews on monitoring results. Prior to starting any new activity, a training session using the Activity Hazard Analyses will be held for crewmembers involved in the activity.

APPENDIX A

HEALTH AND SAFETY FORMS

FORMS FOR HEALTH AND SAFETY-RELATED ACTIVITIES

Field Team Review /Site-Specific Health and Safety Training Form

Signed by all site personnel to indicate that they will comply with and understand the provisions of the HASP.

Field Change Request Form

Used for documenting changes to the HASP. See attached forms.

PPE Selection Form

To be completed for PPE hazard assessment and selection for additional tasks not covered by the HASP.

FIELD CHANGE REQUEST FORM

PROJECT: _____

CHANGE NUMBER: _____

PROJECT LOCATION: _____

DESCRIPTION OF CHANGE: _____

_____

_____

REASON FOR CHANGE: _____

_____

_____

RECOMMENDED DISPOSITION: _____

_____

_____

PROJECT MANAGER:

_____ _____

Signature Date

HASP FIELD CHANGE

Field Change Number: _____ Date Effective: _____

Pen and Ink changes to be made in the HASP to alert the reader of this change:

_____

_____

_____

_____

Reason for the change to be incorporated into the HASP:

_____

_____

_____

_____

_____

_____

TEXT OF CHANGE TO BE INCORPORATED:

_____

_____

_____

_____

_____

_____

FIELD CHANGE RECORDS

Record of Field Changes:

Initial for attaching any Field changes to this HASP. Enter the Field Change Number and Date Issued. File the completed field changes to this HASP at the end as attachments. Make PEN and INK changes in the text to alert the reader to the changes that are required in the Field Change.

FIELD CHANGE NUMBER	DATE ENTERED	SYNOPSIS OF CHANGE	INITIAL

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the HASP. It is maintained on site by the Site Manager as a project record.

Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read, or have been informed of, the Health and Safety Plan and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	Date

AIR MONITORING:
Real Time

Major Activity	Location(s)	Worker Occupation	FID/PID Range	CGI/O2 Range	PDM Range	Other

PERSONAL AIR MONITORING

Analyte	Activity Monitored	Occupation	Location	Result	Type of Sample*

SUBCONTRACTORS ON SITE

Company Name	Task or Function	Return to Site Next Week (Y/N)

Site Manager - Signature **Date**

PERSONAL PROTECTIVE EQUIPMENT SELECTION

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR

APPENDIX B

CHEMICAL DATA SHEETS

NIOSH Pocket Guide to Chemical Hazards

<<Benzene>>	CAS 71-43-2
C_6H_6	RTECS CY1400000
Synonyms & Trade Names Benzol, Phenyl hydride	**DOT ID & Guide** 1114 130

Exposure Limits	NIOSH REL: Ca TWA 0.1 ppm ST 1 ppm See Appendix A
	OSHA PEL: [1910.1028] TWA 1 ppm ST 5 ppm See Appendix F

IDLH Ca [500 ppm]	**Conversion** 1 ppm = 3.19 mg/m^3

Physical Description
Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

MW: 78.1	BP: 176°F	FRZ: 42°F	Sol: 0.07%
VP: 75 mmHg	IP: 9.24 eV		Sp.Gr: 0.88
Fl.P: 12°F	UEL: 7.8%	LEL: 1.2%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers, many fluorides & perchlorates, nitric acid

Measurement Methods
NIOSH 1500, 1501, 3700, 3800; OSHA 12

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, blood, central nervous system, bone marrow

Cancer Site [leukemia]

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Ethyl <<benzene>>	CAS 100-41-4
$CH_3CH_2C_6H_5$	**RTECS** DA0700000
Synonyms & Trade Names Ethylbenzol, Phenylethane	**DOT ID & Guide** 1175 129

Exposure Limits	NIOSH REL: TWA 100 ppm (435 mg/m^3) ST 125 ppm (545 mg/m^3)
	OSHA PEL†: TWA 100 ppm (435 mg/m^3)

IDLH 800 ppm [10%LEL]	**Conversion** 1 ppm = 4.34 mg/m^3

Physical Description
Colorless liquid with an aromatic odor.

MW: 106.2	BP: 277°F	FRZ: -139°F	Sol: 0.01%
VP: 7 mmHg	IP: 8.76 eV		Sp.Gr: 0.87
Fl.P: 55°F	UEL: 6.7%	LEL: 0.8%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
NIOSH 1501; OSHA 7, 1002

Personal Protection & Sanitation
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Water flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 800 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact
Symptoms Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma
Target Organs Eyes, skin, respiratory system, central nervous system
See also: INTRODUCTION

dtSearch 6.22 (6366)

NIOSH Pocket Guide to Chemical Hazards

Toluene	**CAS** 108-88-3
$C_6H_5CH_3$	**RTECS** XS5250000
Synonyms & Trade Names Methyl <<benzene>>, Methyl benzol, Phenyl methane, Toluol	**DOT ID & Guide** 1294 130

Exposure Limits	NIOSH REL: TWA 100 ppm (375 mg/m^3) ST 150 ppm (560 mg/m^3)
	OSHA PEL†: TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)

IDLH 500 ppm	**Conversion** 1 ppm = 3.77 mg/m^3

Physical Description
Colorless liquid with a sweet, pungent, <<benzene>>-like odor.

MW: 92.1	BP: 232°F	FRZ: -139°F	Sol(74°F): 0.07%
VP: 21 mmHg	IP: 8.82 eV		Sp.Gr: 0.87
Fl.P: 40°F	UEL: 7.1%	LEL: 1.1%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
NIOSH 1500, 1501, 3800, 4000; OSHA 111

Personal Protection & Sanitation	**First Aid** (See procedures)
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
Up to 500 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact
Symptoms Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage
Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys
See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

m-<<Xylene>>	CAS 108-38-3
$C_6H_4(CH_3)_2$	RTECS ZE2275000
Synonyms & Trade Names 1,3-Dimethylbenzene; meta-<<Xylene>>; m-Xylol	**DOT ID & Guide** 1307 130

Exposure Limits	NIOSH REL: TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3)
	OSHA PEL†: TWA 100 ppm (435 mg/m^3)

IDLH 900 ppm	**Conversion** 1 ppm = 4.34 mg/m^3

Physical Description
Colorless liquid with an aromatic odor.

MW: 106.2	BP: 282°F	FRZ: -54°F	Sol: Slight
VP: 9 mmHg	IP: 8.56 eV		Sp.Gr: 0.86
Fl.P: 82°F	UEL: 7.0%	LEL: 1.1%	

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong acids

Measurement Methods
NIOSH 1501, 3800; OSHA 1002

Personal Protection & Sanitation
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 900 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination,

staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis
Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys
See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

o-<<Xylene>>	CAS 95-47-6
$C_6H_4(CH_3)_2$	RTECS ZE2450000
Synonyms & Trade Names 1,2-Dimethylbenzene; ortho-<<Xylene>>; o-Xylol	**DOT ID & Guide** 1307 130

Exposure Limits	NIOSH REL: TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3)
	OSHA PEL†: TWA 100 ppm (435 mg/m^3)
IDLH 900 ppm	**Conversion** 1 ppm = 4.34 mg/m^3

Physical Description
Colorless liquid with an aromatic odor.

MW: 106.2	BP: 292°F	FRZ: -13°F	Sol: 0.02%
VP: 7 mmHg	IP: 8.56 eV		Sp.Gr: 0.88
Fl.P: 90°F	UEL: 6.7%	LEL: 0.9%	

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong acids

Measurement Methods
NIOSH 1501, 3800; OSHA 1002

Personal Protection & Sanitation
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 900 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination,

staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis
Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys
See also: INTRODUCTION

dtSearch 6.22 (6366)

NIOSH Pocket Guide to Chemical Hazards

p-<<Xylene>>	CAS 106-42-3
$C_6H_4(CH_3)_2$	RTECS ZE2625000
Synonyms & Trade Names 1,4-Dimethylbenzene; para-<<Xylene>>; p-Xylol	**DOT ID & Guide** 1307 130

Exposure Limits	NIOSH REL: TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3)
	OSHA PEL†: TWA 100 ppm (435 mg/m^3)

IDLH 900 ppm	**Conversion** 1 ppm = 4.41 mg/m^3

Physical Description
Colorless liquid with an aromatic odor. [Note: A solid below 56°F.]

MW: 106.2	BP: 281°F	FRZ: 56°F	Sol: 0.02%
VP: 9 mmHg	IP: 8.44 eV		Sp.Gr: 0.86
Fl.P: 81°F	UEL: 7.0%	LEL: 1.1%	

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong acids

Measurement Methods
NIOSH 1501, 3800; OSHA 1002

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 900 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination,

staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis
Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys
See also: INTRODUCTION

dtSearch 6.22 (6366)

NIOSH Pocket Guide to Chemical Hazards

<<Coal>> <<tar>> pitch volatiles	CAS 65996-93-2
	RTECS GF8655000
Synonyms & Trade Names Synonyms vary depending upon the specific compound (e.g., pyrene, phenanthrene, acridine, chrysene, anthracene & benzo(a)pyrene). [Note: NIOSH considers <<coal>> <<tar>>, <<coal>> <<tar>> pitch, and creosote to be <<coal>> <<tar>> products.]	**DOT ID & Guide**

Exposure Limits	NIOSH REL: Ca TWA 0.1 mg/m^3 (cyclohexane-extractable fraction) See Appendix A See Appendix C
	OSHA PEL: TWA 0.2 mg/m^3 (benzene-soluble fraction) [1910.1002] See Appendix C

IDLH Ca [80 mg/m^3]	**Conversion**

Physical Description
Black or dark-brown amorphous residue.

Properties vary depending upon the specific compound.			

Combustible Solids

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
OSHA 58

Personal Protection & Sanitation	**First Aid** (See procedures)
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: Daily Remove: No recommendation Change: Daily	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/Any appropriate

escape-type, self-contained breathing apparatus
Exposure Routes inhalation, skin and/or eye contact
Symptoms Dermatitis, bronchitis, [potential occupational carcinogen]
Target Organs respiratory system, skin, bladder, kidneys **Cancer Site** [lung, kidney & skin cancer]
See also: INTRODUCTION

dtSearch 6.22 (6366)

NIOSH Pocket Guide to Chemical Hazards

<<Naphthalene>>	CAS 91-20-3
$C_{10}H_8$	RTECS QJ0525000
Synonyms & Trade Names Naphthalin, Tar camphor, White tar	**DOT ID & Guide** 1334 133 (crude or refined) 2304 133 (molten)

Exposure Limits	NIOSH REL: TWA 10 ppm (50 mg/m^3) ST 15 ppm (75 mg/m^3)
	OSHA PEL†: TWA 10 ppm (50 mg/m^3)

IDLH 250 ppm	**Conversion** 1 ppm = 5.24 mg/m^3

Physical Description
Colorless to brown solid with an odor of mothballs. [Note: Shipped as a molten solid.]

MW: 128.2	BP: 424°F	MLT: 176°F	Sol: 0.003%
VP: 0.08 mmHg	IP: 8.12 eV		Sp.Gr: 1.15
Fl.P: 174°F	UEL: 5.9%	LEL: 0.9%	

Combustible Solid, but will take some effort to ignite.

Incompatibilities & Reactivities
Strong oxidizers, chromic anhydride

Measurement Methods
NIOSH 1501; OSHA 35

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Molten flush immediately/solid-liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 100 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s) in combination with a dust and mist filter*/(APF = 10) Any supplied-air respirator*
Up to 250 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*/(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s) in combination with a dust and mist filter*/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary

self-contained positive-pressure breathing apparatus Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus
Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact
Symptoms Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage
Target Organs Eyes, skin, blood, liver, kidneys, central nervous system
See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

<<Nitric>> <<acid>>	CAS 7697-37-2
HNO_3	RTECS QU5775000
Synonyms & Trade Names Aqua fortis, Engravers <<acid>>, Hydrogen nitrate, Red fuming <<nitric>> <<acid>> (RFNA), White fuming <<nitric>> <<acid>> (WFNA)	**DOT ID & Guide** 1760 154 (</=40% <<acid>>) 2031 157 (>40% <<acid>>) 2032 157 (fuming)

Exposure Limits	NIOSH REL: TWA 2 ppm (5 mg/m^3) ST 4 ppm (10 mg/m^3)
	OSHA PEL†: TWA 2 ppm (5 mg/m^3)
IDLH 25 ppm	**Conversion** 1 ppm = 2.58 mg/m^3

Physical Description
Colorless, yellow, or red, fuming liquid with an acrid, suffocating odor. [Note: Often used in an aqueous solution. Fuming <<nitric>> <<acid>> is concentrated <<nitric>> <<acid>> that contains dissolved nitrogen dioxide.]

MW: 63.0	BP: 181°F	FRZ: -44°F	Sol: Miscible
VP: 48 mmHg	IP: 11.95 eV		Sp.Gr(77°F): 1.50
Fl.P: NA	UEL: NA	LEL: NA	

Noncombustible Liquid, but increases the flammability of combustible materials.

Incompatibilities & Reactivities
Combustible materials, metallic powders, hydrogen sulfide, carbides, alcohols [Note: Reacts with water to produce heat. Corrosive to metals.]

Measurement Methods
NIOSH 7903; OSHA 1D165SG

Personal Protection & Sanitation	**First Aid** (See procedures)
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: No recommendation Provide: Eyewash (pH<2.5), Quick drench (pH<2.5)	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 25 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*/(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern¿/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern¿/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any

supplied-air respirator with a full facepiece Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern¿/Any appropriate escape-type, self-contained breathing apparatus
Exposure Routes inhalation, ingestion, skin and/or eye contact
Symptoms Irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion
Target Organs Eyes, skin, respiratory system, teeth
See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

<<Phenol>>	CAS 108-95-2
C_6H_5OH	RTECS SJ3325000
Synonyms & Trade Names Carbolic acid, Hydroxybenzene, Monohydroxybenzene, Phenyl alcohol, Phenyl hydroxide	**DOT ID & Guide** 1671 153 (solid) 2312 153 (molten) 2821 153 (solution)

Exposure Limits	NIOSH REL: TWA 5 ppm (19 mg/m^3) C 15.6 ppm (60 mg/m^3) [15-minute] [skin]
	OSHA PEL: TWA 5 ppm (19 mg/m^3) [skin]

IDLH 250 ppm	**Conversion** 1 ppm = 3.85 mg/m^3

Physical Description
Colorless to light-pink, crystalline solid with a sweet, acrid odor. [Note: <<Phenol>> liquefies by mixing with about 8% water.]

MW: 94.1	BP: 359°F	MLT: 109°F	Sol(77°F): 9%
VP: 0.4 mmHg	IP: 8.50 eV		Sp.Gr: 1.06
Fl.P: 175°F	UEL: 8.6%	LEL: 1.8%	

Combustible Solid

Incompatibilities & Reactivities
Strong oxidizers, calcium hypochlorite, aluminum chloride, acids

Measurement Methods
NIOSH 2546; OSHA 32

Personal Protection & Sanitation	**First Aid** (See procedures)
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 50 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s) in combination with a dust and mist filter/(APF = 10) Any supplied-air respirator
Up to 125 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s) in combination with a dust and mist filter
Up to 250 ppm: (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate

filter/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching

Target Organs Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

<<Hydrogen>> <<cyanide>>	CAS 74-90-8
HCN	**RTECS** MW6825000
Synonyms & Trade Names Formonitrile, Hydrocyanic acid, Prussic acid	**DOT ID & Guide** 1051 117 (>20% solution) 1051 117 (anhydrous) 1613 154 (</=20% solution)

Exposure Limits	NIOSH REL: ST 4.7 ppm (5 mg/m^3) [skin]
	OSHA PEL†: TWA 10 ppm (11 mg/m^3) [skin]

IDLH 50 ppm	**Conversion** 1 ppm = 1.10 mg/m^3

Physical Description
Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. [Note: Often used as a 96% solution in water.]

MW: 27.0	BP: 78°F (96%)	FRZ: 7°F (96%)	Sol: Miscible
VP: 630 mmHg	IP: 13.60 eV		Sp.Gr: 0.69
Fl.P: 0°F (96%)	UEL: 40.0%	LEL: 5.6%	

Class IA Flammable Liquid Flammable Gas

Incompatibilities & Reactivities
Amines, oxidizers, acids, sodium hydroxide, calcium hydroxide, sodium carbonate, caustics, ammonia [Note: Can polymerize at 122-140°F.]

Measurement Methods
NIOSH 6010

Personal Protection & Sanitation	**First Aid** (See procedures)
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation Provide: Eyewash, Quick drench	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
Up to 47 ppm: (APF = 10) Any supplied-air respirator
Up to 50 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary

self-contained positive-pressure breathing apparatus Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact
Symptoms Asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes
Target Organs central nervous system, cardiovascular system, thyroid, blood
See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

<<Hydrogen>> <<sulfide>>	CAS 7783-06-4
H_2S	**RTECS** MX1225000
Synonyms & Trade Names Hydrosulfuric acid, Sewer gas, Sulfuretted <<hydrogen>>	**DOT ID & Guide** 1053 117

Exposure Limits	NIOSH REL: C 10 ppm (15 mg/m^3) [10-minute]
	OSHA PEL†: C 20 ppm 50 ppm [10-minute maximum peak]

IDLH 100 ppm	**Conversion** 1 ppm = 1.40 mg/m^3

Physical Description
Colorless gas with a strong odor of rotten eggs. [Note: Sense of smell becomes rapidly fatigued & can NOT be relied upon to warn of the continuous presence of H_2S. Shipped as a liquefied compressed gas.]

MW: 34.1	BP: -77°F	FRZ: -122°F	Sol: 0.4%
VP: 17.6 atm	IP: 10.46 eV	RGasD: 1.19	
Fl.P: NA (Gas)	UEL: 44.0%	LEL: 4.0%	

Flammable Gas

Incompatibilities & Reactivities
Strong oxidizers, strong nitric acid, metals

Measurement Methods
NIOSH 6013; OSHA ID141

Personal Protection & Sanitation	**First Aid** (See procedures)
Skin: Frostbite Eyes: Frostbite Wash skin: No recommendation Remove: When wet (flammable) Change: No recommendation Provide: Frostbite	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support

Respirator Recommendations NIOSH
Up to 100 ppm: (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or

back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
Exposure Routes inhalation, skin and/or eye contact
Symptoms Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite
Target Organs Eyes, respiratory system, central nervous system
See also: INTRODUCTION

MATERIAL SAFETY DATA SHEET: SIMPLE GREEN®

I. PRODUCT & COMPANY INFORMATION

PRODUCT NAME: **SIMPLE GREEN® CLEANER / DEGREASER / DEODORIZER**

COMPANY NAME: **SUNSHINE MAKERS, INC.**
15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 • 562-795-6000
Fax: 562-592-3034
Website: www.simplegreen.com

Version No. 1007
Issue Date: January, 2002

For 24-hour emergency, call Chem-Tel, Inc.: 800-255-3924

USE OF PRODUCT: An all purpose cleaner and degreaser used undiluted or diluted in water for direct, spray, and dip tank procedures.

II. INGREDIENT INFORMATION

The only ingredient of Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<6%) (Butyl Cellosolve; CAS No. 111-76-2): the OSHA PEL and ACGIH TLV is 25 ppm (skin). Note, however, that Butyl Cellosolve is only one of the raw material ingredients that undergo processing and dilution during the manufacture of Simple Green®. Upon completion of the manufacturing process, Simple Green® does not possess the occupational health risks associated with exposure to undiluted Butyl Cellosolve. Verification of this is contained in the independent test results detailed under "Toxicological Information" on Page 3 of this MSDS.

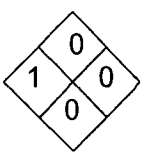
The Butyl Cellosolve in Simple Green® is part of a chemical category (glycol ethers) regulated by the Emergency Planning and Community Right-to-Know Act (SARA, Title III, section 313); therefore, a reporting requirement exists. Based upon chemical analysis, Simple Green® contains no known EPA priority pollutants, heavy metals, or chemicals listed under RCRA, CERCLA, or CWA. Analysis by TCLP (Toxicity Characteristic Leaching Procedure) according to RCRA revealed no toxic organic or inorganic constituents.

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

III. HAZARDS IDENTIFICATION

UN Number: Not required
Dangerous Goods Class: Nonhazardous

Hazard Rating (NFPA/HMIS)
Health = 1* Reactivity = 0
Fire = 0 Special = 0



Rating Scale
0 = minimal 1 = slight
2 = moderate 3 = serious
4 = severe

*Mild eye irritant, non-mutagenic and non-carcinogenic. **None of the ingredients in Simple Green® are regulated or listed as potential cancer agents by Federal OSHA, NTP, or IARC.**

IV. FIRST AID MEASURES

SYMPTOMS OF OVEREXPOSURE AND FIRST AID TREATMENT

Eye contact: Reddening may develop. Immediately rinse the eye with large quantities of cool water; continue 10-15 minutes or until the material has been removed; be sure to remove contact lenses, if present, and to lift upper and lower lids during rinsing. Get medical attention if irritation persists.

Skin contact: Minimal effects, if any; rinse skin with water, rinse shoes and launder clothing before reuse. Reversible reddening may occur in some dermal-sensitive users; thoroughly rinse area and get medical attention if reaction persists.

Swallowing: Essentially non-toxic. Give several glasses of water to dilute; do not induce vomiting. If stomach upset occurs, consult physician.

Inhalation: Non-toxic. Exposures to concentrate-mist may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.

V. FIRE FIGHTING MEASURES

Simple Green® is stable, not flammable, and will not burn.

Flash Point/Auto-Ignition:	Not flammable.
Flammability Limits:	Not flammable.
Extinguishing Media:	Not flammable/nonexplosive. No special procedures required.
Special Fire Fighting Procedures:	None required.

VI. ACCIDENTAL RELEASE MEASURES

Recover usable material by convenient method; residual may be removed by wipe or wet mop. If necessary, unrecoverable material may be washed to drain with large quantities of water.

VII. HANDLING, STORAGE & TRANSPORT INFORMATION

No special precautions are required. **This product is non-hazardous for storage and transport according to the U.S. Department of Transportation Regulations.** Simple Green® requires no special labeling or placarding to meet U.S. Department of Transportation requirements.

UN Number: Not required Dangerous Goods Class: Non-hazardous

VIII. EXPOSURE CONTROLS

Exposure Limits: The Simple Green® formulation presents no health hazards to the user when used according to label directions for its intended purposes. Mild skin and eye irritation is possible (please see Eye contact and Skin contact in Section IV.).

Ventilation: No special ventilation is required during use.

Human Health Effects or Risks from Exposure: Adverse effects on human health are not expected from Simple Green®, based upon twenty years of use without reported adverse health incidence in diverse population groups, including extensive use by inmates of U.S. Federal prisons in cleaning operations.

Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate-mist.

Simple Green® is not likely to irritate the skin in the majority of users. Repeated daily application to the skin without rinsing, or continuous contact of Simple Green® on the skin may lead to temporary, but reversible, irritation.

Medical Conditions Aggravated by Exposure: No aggravation of existing medical conditions is expected; dermal sensitive users may react to dermal contact by Simple Green®.

IX. PERSONAL PROTECTION

Precautionary Measures:	No special requirements under normal use conditions.
Eye Protection:	**Caution, including reasonable eye protection, should always be used to avoid eye contact where splashing may occur.**
Skin Protection:	No special precautions required; rinse completely from skin after contact.
Respiratory Protection:	No special precautions required.
Work and Hygienic Practices:	No special requirements. Wash or rinse hands before touching eyes or contact lenses.

X. PHYSICAL AND CHEMICAL PROPERTIES

Appearance/odor: Translucent green liquid with characteristic sassafras odor.
Specific Gravity: 1.0257 **Vapor Pressure:** 17 mm Hg @ 20 °C; 22 mm Hg @ 25 °C
pH of concentrate: 9.5 **Vapor Density:** 1.3 (air = 1)
Evaporation: >1 (butyl acetate = 1) **Density:** 8.5 lbs./gallon
Boiling Point: 110 °C (231 °F)
Freezing Point: -9 °C (16 °F) If product freezes, it will reconstitute without loss of efficacy when brought back to room temperature and agitated.
VOC Composite Partial Pressure: 0.006 mm Hg @ 20 °C
Volatile Organic Compounds (VOCs): 7.96 g/L per ASTM Method 3960-90. Per California AQMD's VOC test method, product must be diluted at least 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.

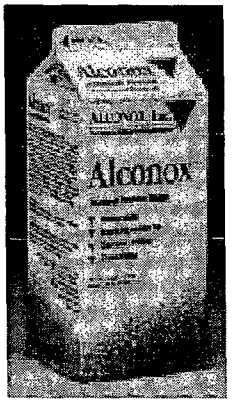
***** NOTICE *****

SPI Supplies Division
Structure Probe, Inc.
P.O. Box 656 West Chester, PA 19381-0656 USA
Phone: *1-(610)-436-5400* ***Fax:*** *1-(610)-436-5755*
E-mail: *spi3spi@2spi.com*
WWW: http://www.2spi.com
Manufacturer's CAGE: 1P573

Material Safety Data Sheet

SPI #01200-AB and #01200A-AB <<Alconox>>® Powdered Detergent

Section 1: Identification



Date Effective..... May 25, 2000
(most recent revision)

Chemical Name/Synonyms... On Label: <<Alconox>>®

Chemical Family..... Anionic powdered detergent

Emergencies
Contacting CHEMTREC:

24 Hour Emergency Use Only #'s...
Worldwide phone: 1-(703)-527-3887
Worldwide FAX: 1-(703)-741-6090
Toll-free phone: 1-(800)-242-9300 USA only

Product or Trade Name.... SPI #01200-AB and #01200A-AB
<<Alconox>>® Powdered Detergent

CAS #..... Not applicable

Chemical Formula..... Not applicable

Section 2 Composition

Component Name	CAS #	OSHA	OSHA	ACGIH	ACGIH

No hazardous ingredients in <<Alconox>> Powdered Detergent as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

NFPA Rating: Not known

Section 3: Hazard Identification

Routes of entry
Inhalation? Yes
Skin? No
Ingestion? Yes

Health Hazards (Acute and chronic):
Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.

Carcinogenicity:
NTP? No
IARC Monographs? No
OSHA Regulated? No

Section 4: First Aid Measures

Signs and Symptoms of Exposure:
Exposure may irritate mucous membranes. May cause sneezing.

Medical conditions generally aggrivated by exposure:
Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggrivated by powder if air borne.

Emergency and First Aid Procedures:

Eyes: Immediately flush eyes with copious amounts of water for minimum 15 minutes. Call physician.

Skin: Flush with plenty of water.

Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs re-administer fluids. See a physician for discomfort.

Section 5: Fire Fighting Measures

NFPA Rating: Not known

Extinguishing Media

Suitable/Not suitable:

SMALL FIRE: Use DRY chemical powder, water, foam, carbon dioxide

LARGE FIRE: Use extinguishing media suitable for the

surrounding materials.

Special firefighting procedures:
Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.

Unusual Fire/Explosion Hazards: None

Hazardous thermal decomposition products: None known.

Protection of fire fighters: No special measures are required.

Flammable Limits:
LEL: No data
UEL: No data

Section 6: Accidental Release Measures

Personal precautions: No special precautions

Environmental Precautions and Clean Up Methods:
Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.

Section 7: Handling and Storage

Material should be stored in a dry area to prevent caking.

Section 8: Exposure Controls and Personal Protection

Engineering controls: Normal ventilation is normally required when handling or using this product. Avoid conditions that could produce dusting.

Personal Protective Equipment

Respiratory system: Dust mask recommended but not required.

Skin and body: Laboratory coat recommended but not required.

Hands: Impervious gloves recommended

Eyes: Goggles are recommended, especially when handling solutions irrespective of what they might be.

Other: Wash hands before eating, drinking, or smoking.

Section 9: Physical and Chemical Properties

Physical State and Appearance: White powder interspersed with cream colored flakes.

Odor: None

Boiling Point: Not applicable

Melting Point: Not applicable

Density (water = 1): Not applicable

Solubility: Appreciable, to 10% at ambient conditions.

Octanol/water partition coefficient: Not available

pH: Not known

Flash Point: None

Flammability: Non-flammable

Autoignition temperature: Not applicable

Section 10: Stability and Reactivity

Chemical Stability: The product is stable

Hazardous polymerization: Will not occur

Conditions to Avoid: None

Hazardous Products of Deposition: May release CO_2 on burning.

Reactions with Air and Water:
Does not react with air, water or other common materials.

Section 11: Toxicological Information

Summary: Not considered to be toxic to humans or animals.

Skin Effects: Can be locally irritating

Eye Irritation: Can be irritating to the eyes

Inhalation: Dust can be irritating to mucous membranes

Sensitization: Not known

Chronic toxicity: There is no known effect from the chronic exposure to this product.

Section 12: Ecological Information

Exotoxicity: Not know but it is expected to be low because the material is biodegradable.

Environmental Fate: It is biodegradable.

Bioaccumulation: Not expected to occur (because the material is biodegradable).

Section 13: Disposal Considerations

This material is NOT classified as a hazardous material by RCRA. Use only licensed transporters and permitted disposal facilities and conform to all laws.

Recycle to process, if possible.

Germany water class: VCI WGK: No products were found.

Methods of disposal; waste of residues; contaminated packaging:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

Proper Shipping Name: Non-Regulated, No dangerous cargo

DOT Hazard Class: Non-Regulated, No dangerous cargo

UN/NA ID: Non-Regulated, No dangerous cargo

Packing Group: Not Applicable

Labels: Not Regulated

Marine Pollutant: No

NAER Guidebook: Not Regulated

DOT Status: Not Regulated

Land-Road/Railway:

ADR/RID Class: No dangerous cargo

Sea:

IMDG Class: No dangerous cargo

Air:

IATA-DGR Class: No dangerous cargo

Section 15: Regulatory Information

TSCA: All components of this product are listed on the TSCA 8(b) inventory. If identified components of this product are listed under the TSCA 12(b) Export Notification Rule, they will be listed below.

TSCA 12(b) Component Listed under TSCA Section

SARA Title 3: Section 313 Information/Emissions Reporting (**40 CFR 372**):

Component Reporting Threshold

SARA-Section 311/312:

No components present in this product are subject to the reporting requirements of this statute.

CERCLA Hazardous Substances and their Reportable Quantities:

Component Reportable Quantity

EU Regulations: Risk Phrases: This product is not classified according to the EU regulations.

Safety Phrases: Not applicable

Contains: Not applicable

California Prop. 65:
Proposition 65 requires manufacturers or distributors of consumer products into the State of California to provide a warning statement if the product contains ingredients for which the State has found to cause cancer, birth defects or other reproductive harm. If this product contains an ingredient listed by the State of California to cause cancer or reproductive toxicity, it will be listed below:

None found

Section 16: Other Information

Disclaimer of Liability:

Caution! Do not use SPI Supplies products or materials in applications involving implantation within the body; direct or indirect contact with the blood pathway; contact with bone, tissue, tissue fluid, or blood; or prolonged contact with mucous membranes. Products offered by SPI Supplies are not designed or manufactured for use in implantation in the human body or in contact with internal body fluids or tissues. SPI Supplies will not provide to customers making devices for such applications any notice, certification, or information necessary for such medical device use required by US FDA (Food and Drug Administration) regulation or any other statute. SPI Supplies and Structure Probe, Inc. make no representation, promise, express warranty or implied warranty concerning the suitability of these materials for use in implantation in the human body or in contact with internal body tissues of fluids.

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The information and recommendations set forth above are taken from sources believed to be accurate as of the date hereof, however SPI Supplies and Structure Probe, Inc. make no warranty with respect to the accuracy of the information or the suitability of the recommendations, and assume no liability to any user thereof. The information contained in this sheet does not constitute a hazard assessment and should not be used in place of the user's own assessment of work place risks as required by other health and safety legislation. Be aware of the Structure Probe, Inc. Copyright Policy. Structure Probe, Inc. grants a nonexclusive license to make unlimited copies of this safety sheet for internal use only. Quite obviously, this information would pertain only to this material when purchased from SPI Supplies as product from other sources, with other ingredients and impurity levels could have substantially different properties.

ON-LINE To Ask a Question or Make a Comment

ON-LINE To Place an Order or Request a Quote

Search SPI Navigator Index

Return to:

- <<Alconox>>® Powdered Detergent
- SPI Supplies MSDS Safety Sheets Table of Contents
- SPI Supplies Catalog Table of Contents
- SPI Supplies Home Page

FRIDAY JUNE 08, 2001

Worldwide Distributors, Representatives, and Agents

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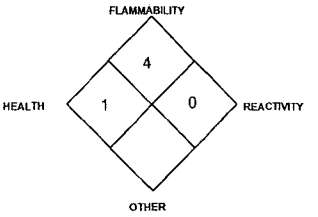
dtSearch 6.22 (6366)

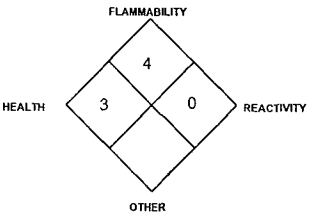
METHANE GAS

NFPA RATING



LIQUID METHANE

NFPA RATING



MATERIAL SAFETY DATA SHEET

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

PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: **METHANE - CH_4, Gaseous**
METHANE - CH_4, Liquefied (Cryogenic)
Document Number: 001033

PRODUCT USE: Fuel and for general analytic/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME: AIRGAS INC.
ADDRESS: 259 N. Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283

BUSINESS PHONE: 1-610-687-5253
EMERGENCY PHONE: 1-800-949-7937
International: 423-479-0293

DATE OF PREPARATION: May 12, 1996
REVISION DATE: January 3, 2001

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	OTHER
Methane	74-82-8	> 99%	There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Maximum Impurities		< 1%	None of the trace impurities in this product contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

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: Methane is an odorless, colorless gas, or a colorless, odorless liquid in its cryogenic form. Both the liquid and the gas pose a serious fire hazard when accidentally released. The liquid will rapidly boil to the gas at standard temperatures and pressures. As a gas, it will act as a simple asphyxiant and present a significant health hazard by displacing the oxygen in the atmosphere. The gas is lighter than air and may spread long distances. Distant ignition and flashback are possible. The liquefied gas can cause frostbite to any contaminated tissue. Flame or high temperature impinging on a localized area of the cylinder of Methane can cause the cylinder to rupture without activating the cylinder's relief devices. Provide adequate fire protection during emergency response situations. Allow the released gas to dissipate in the atmosphere.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure for this gas is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: High concentrations of this gas can cause an oxygen-deficient environment. 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 overexposure, death may occur. The effects associated with various levels of oxygen are as follows:

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

OTHER POTENTIAL HEALTH EFFECTS: Contact with cryogenic liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with the liquid can quickly subside.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	1
FLAMMABILITY	(RED)	4
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		B

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For routine industrial applications

See Section 16 for Definition of Ratings

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**. Overexposure to Methane may cause the following health effects:

ACUTE: The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness, and nausea. At high concentrations, unconsciousness or death may occur. Contact with cryogenic liquid or rapidly expanding gases may cause frostbite.

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

TARGET ORGANS: Respiratory system.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO METHANE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

4. FIRST-AID MEASURES (Continued)

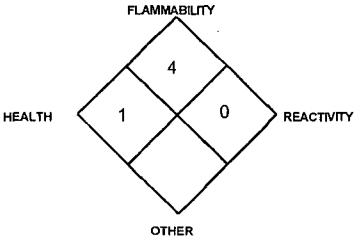
Remove victim(s) to fresh air as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit, Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention. Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

METHANE GAS

NFPA RATING



FLASH POINT (Closed Cup):
-187°C (-306°F)

AUTOIGNITION TEMPERATURE:
537°C (999°F)

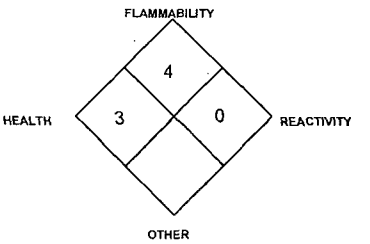
FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 5.0%
Upper (UEL): 15.0%

See Section 16 for Definition of Ratings

LIQUID METHANE

NFPA RATING



FIRE EXTINGUISHING MATERIALS: Extinguish fires of this gas by shutting off the source of the gas. Use water spray to cool fire-exposed containers, structures, and equipment.

UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this gas will ignite and produce toxic gases including carbon monoxide and carbon dioxide. An extreme explosion hazard exists in areas in which the gas has been released, but the material has not yet ignited.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected pressure storage vessels of Methane can be very dangerous and lead to container failure. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

RESPONSE TO FIRE INVOLVING CRYOGEN: Cryogenic liquids can be particularly dangerous during fires because of their potential to rapidly freeze water. Careless use of water may cause heavy icing. Furthermore, relatively warm water greatly increases the evaporation rate of Methane. If large concentrations of Methane gas are present, the water vapor in the surrounding air will condense, creating a dense fog that may make it difficult to find fire exits or equipment. Liquid Methane, when exposed to the atmosphere, will produce a cloud of ice/fog in the air upon its release. A flammable mixture will exist within the vapor cloud and it is advisable that personnel keep well outside the area of visible moisture.

Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Static discharge may cause Methane to ignite explosively.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still-leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation (in enclosed areas) to prevent flammable or explosive mixture formation. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook for additional information.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided. Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves resistant to tears, and Self-Contained Breathing Apparatus.**

Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas, which is lighter than air, to dissipate. Liquid Methane, when exposed to the atmosphere, will produce a cloud of ice/fog in the air upon its release. A flammable mixture will exist within the vapor cloud, and it is advisable that personnel keep well outside the area of visible moisture. If cryogenic liquid is released, keep area clear and allow the liquid to evaporate. The gas that is then formed should be allowed to dissipate.

Monitor the surrounding area for combustible gas levels and oxygen. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Combustible gas concentration must be below 10% of the LEL (LEL = 5.0%) prior to entry. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

RESPONSE TO CRYOGENIC RELEASE: Clear the affected area and allow the liquid to evaporate and the gas to dissipate. After the gas is formed, follow the instructions provided in the previous paragraphs. If the area must be entered by emergency personnel, SCBA, Kevlar gloves, and appropriate foot and leg protection must be worn.

THIS IS AN EXTREMELY FLAMMABLE GAS. Protection of all personnel and the area must be maintained.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Methane IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Methane could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from oxidizers such as oxygen, chlorine, or fluorine. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to work situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand truck. Do not drag, slide, or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Methane. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "*Oxygen Deficient Atmospheres*".

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. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Methane dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the presence of potentially explosive air-gas mixtures and the level of oxygen. Monitoring devices should be installed near the ceiling.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Methane. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of liquid Methane.

HAND PROTECTION: Wear gloves resistant to tears when handling cylinders of Methane. Use low-temperature protective gloves when working with containers of liquid Methane.

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well as fire retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: 0.6784 kg/m^3 (0.042 35 lb/ft^3)
SPECIFIC GRAVITY (air = 1): 0.555
SOLUBILITY IN WATER: Very slight.
EXPANSION RATIO: 626 (cryogenic liquid)
ODOR THRESHOLD: Not applicable. Odorless.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

SPECIFIC VOLUME: 23.7
FREEZING POINT: -182.2°C (-296°F)
BOILING POINT @ 1 atm: -161°C (-258.7°F)
EVAPORATION RATE (n-BuAc): Not applicable.
VAPOR PRESSURE (psia): Not applicable.
pH: Not applicable.

APPEARANCE AND COLOR: Colorless, odorless gas, or colorless, odorless, cryogenic liquid.
HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.
NOTE: This gas is lighter than air and must not be allowed to accumulate in elevated locations.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: When ignited in the presence of oxygen, this gas will burn to produce carbon monoxide, carbon dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers (e.g., chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks, and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

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

SUSPECTED CANCER AGENT: Methane is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, and therefore, is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Methane is not irritating; however, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: Methane does not cause sensitization with prolonged or repeated contact.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Methane on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for Methane.
Embryotoxicity: No embryotoxic effects have been described for Methane.
Teratogenicity: No teratogenicity effects have been described for Methane.
Reproductive Toxicity: No reproductive toxicity effects have been described for Methane.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational 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 overexposure to the components of Methane.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen if necessary. Treat symptoms and eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Methane.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Methane occurs naturally in the atmosphere. This gas will be dissipated rapidly in well-ventilated areas.
EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen-deficient environments. No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.
EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of Methane on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to Airgas. Do not dispose locally.

14. TRANSPORTATION INFORMATION

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

For Methane Gas:

PROPER SHIPPING NAME:	Methane, compressed
HAZARD CLASS NUMBER and DESCRIPTION:	2.1 (Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1971
PACKING GROUP:	Not Applicable
DOT LABEL(S) REQUIRED:	Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 115

For Liquefied Methane:

PROPER SHIPPING NAME:	Methane, refrigerated liquid
HAZARD CLASS NUMBER and DESCRIPTION:	2.1 (Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1972
PACKING GROUP:	Not Applicable
DOT LABEL(S) REQUIRED:	Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 115

MARINE POLLUTANT: Methane is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Methane is not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL/NDSL INVENTORY STATUS: Methane is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Methane is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Methane is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 lb. Depending on specific operations involving the use of Isobutylene, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Methane is not listed in Appendix A; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Methane is covered under specific State regulations, as denoted below:

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

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Methane is not on the California Proposition 65 lists.

LABELING:

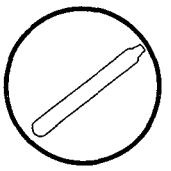
DANGER: FLAMMABLE HIGH PRESSURE GAS.
CAN FORM EXPLOSIVE MIXTURES WITH AIR.

Keep away from heat, flames, and sparks.
Store and use width adequate ventilation.
Use equipment rated for cylinder pressure.
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

DO NOT REMOVE THIS PRODUCT LABEL

CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas
Class B1: Flammable Gas



16. OTHER INFORMATION

PREPARED BY: **Airgas - SAFECOR**

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by **OSHA**. The OSHA Permissible Exposure Limits are based in the 1989 **PELs** and the June, 1993 Air Contaminants Rule (Federal Register. 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration **(OSHA)**. **NIOSH** issues exposure guidelines called Recommended Exposure Levels **(RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below **23**°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued): Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association **(NFPA)**. Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to **4**. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo, LDLo**, and **LDo**, or **TC, TCo, LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act **(SARA)**; the Canadian Domestic/Non-Domestic Substances List **(DSL/NDSL)**; the U.S. Toxic Substance Control Act **(TSCA)**; Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act **(CERCLA** or **Superfund)**; and various state regulations.

APPENDIX C

WORK RULES

GENERAL HEALTH AND SAFETY WORK RULES

1. All site personnel must attend each day's Daily Briefing.
2. All site personnel shall wear the personal protective equipment specified by the HASP(s). This includes hard hats and safety glasses, which must be worn at all times in active work areas.
3. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.
4. All personnel must sign the site log and the exclusion zone log when used at the site.
5. Personnel must follow proper decontamination procedures including, if required, showering at the end of the work shift.
6. Eating, drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the Site Manager to allow fluid intake during heat stress conditions.)
7. All lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.
8. All signs and demarcations shall be followed. Such signs and demarcation shall not be removed, except as authorized by the Site Manager.
9. No one shall enter a permit-required confined space without a permit. Confined space entry permits shall be implemented as issued.
10. All personnel must follow Hot Work Permits as issued.
11. All personnel must use the Site personnel System in the Exclusion Zone.
12. All personnel must follow the work-rest regimens and other practices required by the heat stress program.

HEALTH AND SAFETY WORK RULES

13. All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.
14. No person shall operate equipment unless trained and authorized.
15. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.
16. Ladders and scaffolds shall be solidly constructed, in good working condition, and inspected prior to use. No one may use defective ladders or scaffolds.
17. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.
18. The Supervisor must select safety belts, harnesses and lanyards. The user must inspect the equipment prior to use. Only properly functioning personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.
19. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.
20. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out walkways and puddles unless protected and rated for the service.
21. Improper use, mishandling, or tampering with health and safety equipment and samples is prohibited.
22. Horseplay of any kind is prohibited.
23. Possession or use of alcoholic beverages, controlled substances, or firearms on any site is strictly forbidden.
24. All incidents, no matter how minor, must be reported immediately to the Site Manager/PM.
25. All personnel shall be familiar with the Site Emergency Response Plan.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with all regulations set forth by OSHA, the site HASP, KeySpan Energy, the Site Manager and the Project Manager.

APPENDIX D

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

All monitoring instruments must be calibrated and maintained periodically. The operator must understand the limitations and possible sources of errors for each instrument. It is important that the operator ensures that the instrument responds properly to the substances it was designed to monitor. Portable air quality monitoring equipment that measures total ionizables present, such as the Photovac Micro-TIP HL-2000, must be calibrated at least twice each day, before and after each shift. Combustible gas/oxygen/%LEL meters such as the MSA Model 360 must be calibrated at least twice each day, before and after each shift. Real time aerosol monitors, such as the MINI-RAM, must be zeroed at the beginning of each sampling period. The specific instructions for calibration and maintenance provided for each instrument should be followed.

APPENDIX E

ACTIVITY HAZARD ANALYSIS

KeySpan Greenpoint LNG Facility Site Investigation Task Specific Hazard Assessment		
Project Task	**Potential Hazards**	
	Chemical	**Physical**
Hand Digging/Vacuum Soil Removal	Exposure to MGP related wastes, including volatile organic compounds, Polynuclear aromatic compounds, and metals. Inhalation, ingestion, and dermal absorption may all be potential exposure pathways.	> Exposure to energized electrical lines/equipment (both above and below grade) > Exposure to LNG related piping (above and below grade) > Exposure to vehicle traffic on active roadways > Slip, trip, and fall hazards due to rough/irregular terrain > Potential exposure to noise from drilling/excavation equipment > Heat stress
Drilling – Installation of Groundwater Monitoring Wells	Exposure to MGP related wastes, including volatile organic compounds, Polynuclear aromatic compounds, and metals. Inhalation, ingestion, and dermal absorption may all be potential exposure pathways.	> Exposure to energized electrical lines/equipment (both above and below grade) > Exposure to LNG related piping (above and below grade) > Exposure to vehicle traffic on active roadways > Slip, trip, and fall hazards due to rough/irregular terrain > Potential exposure to noise from drilling/excavation equipment > Heat stress

Development of Groundwater Monitoring Wells	Exposure to MGP related wastes, including volatile organic compounds, Polynuclear aromatic compounds, and metals. Inhalation, ingestion, and dermal absorption may all be potential exposure pathways.	> Exposure to energized electrical lines/equipment (both above and below grade) > Exposure to LNG related piping (above and below grade) > Exposure to vehicle traffic on active roadways > Slip, trip, and fall hazards due to rough/irregular terrain > Potential exposure to noise from drilling/excavation equipment > Heat stress
Collection of Soil and Groundwater Samples	Exposure to MGP related wastes, including volatile organic compounds, Polynuclear aromatic compounds, and metals. Inhalation, ingestion, and dermal absorption may all be potential exposure pathways.	> Exposure to energized electrical lines/equipment (both above and below grade) > Exposure to LNG related piping (above and below grade) > Exposure to vehicle traffic on active roadways > Slip, trip, and fall hazards due to rough/irregular terrain > Potential exposure to noise from drilling/excavation equipment > Heat stress

APPENDIX F

HOSPITAL ROUTE MAP AND DIRECTION

KEYSPAN GREENPOINT TO WOODHULL MEDICAL CTR.

MAPQUEST.

Send To Printer Back To Directions

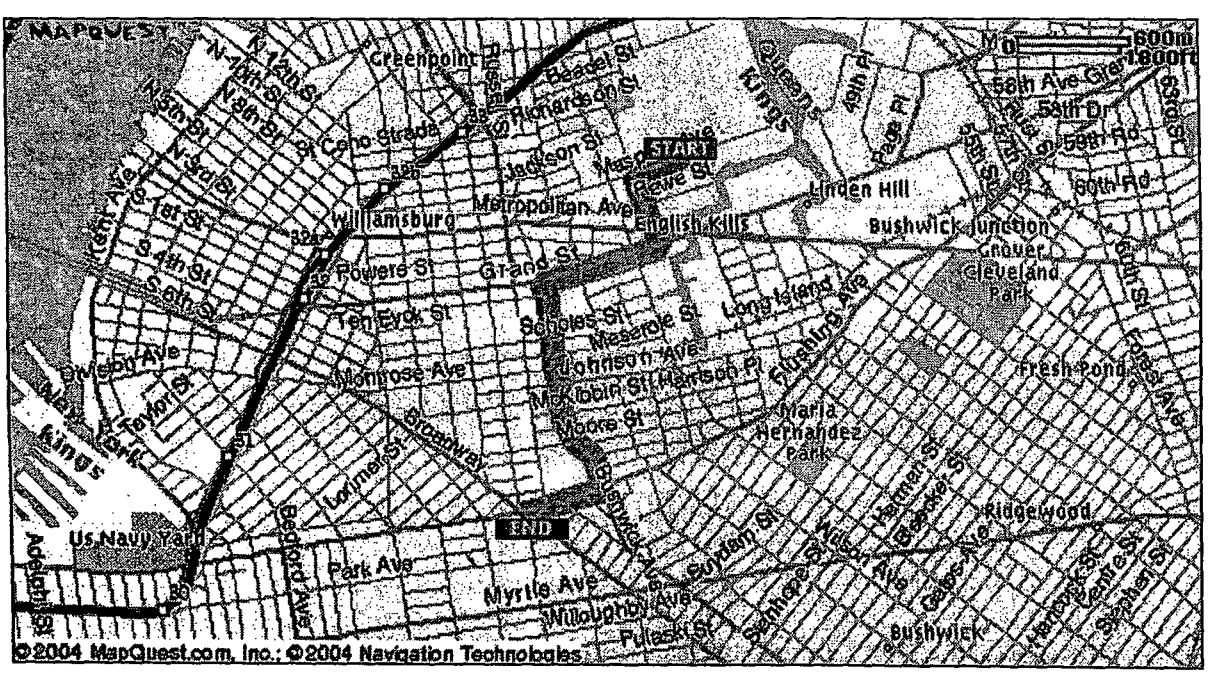
Start: 287 Maspeth Ave
Brooklyn, NY
11211-1703 US

End: 760 Broadway
Brooklyn, NY
11206-5317 US

Distance: 1.88 miles

Total Estimated Time: 6 minutes

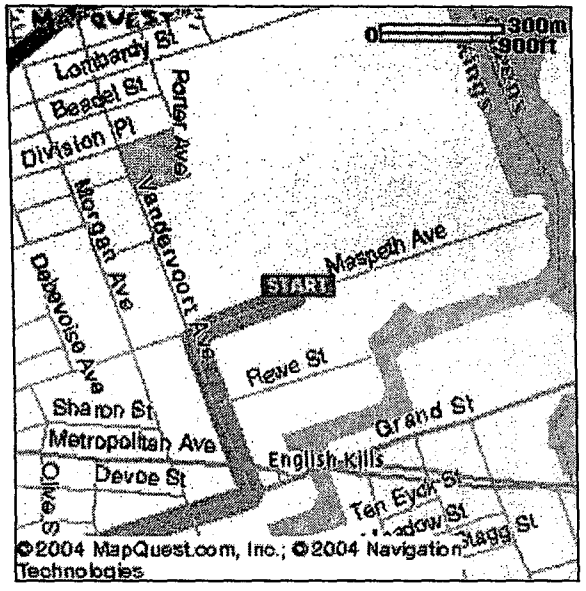
Directions	Distance
START **1.** Start out going West on MASPETH AVE toward VANDERVOORT AVE.	0.1 miles
2. Turn LEFT onto VANDERVOORT AVE.	0.2 miles
3. Turn RIGHT onto GRAND ST.	0.4 miles
4. Turn LEFT onto BUSHWICK AVE.	0.7 miles
5. Turn RIGHT onto FLUSHING AVE.	0.2 miles
6. Turn SHARP LEFT onto BROADWAY.	<0.1 miles
END **End at 760 Broadway, Brooklyn, NY 11206-5317 US**	



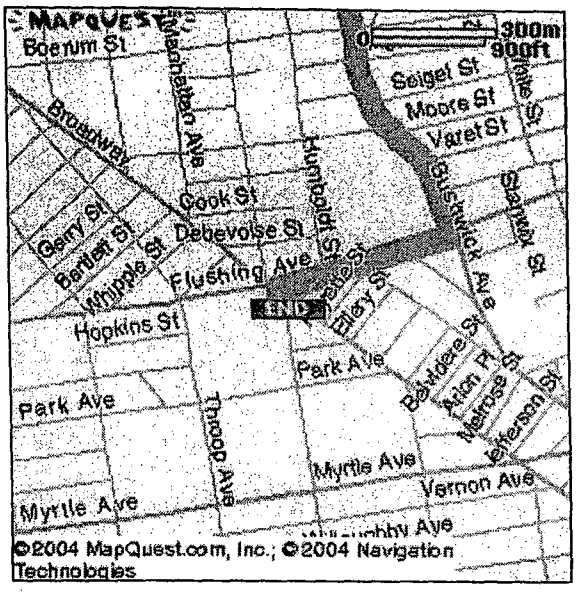
Start:
287 Maspeth Ave

End:
760 Broadway

Brooklyn, NY
11211-1703 US



Brooklyn, NY
11206-5317 US



NAVTECH ON BOARD

Notes: